JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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VOL. C., No. 2328.—TUESDAY, DECEMBER 24, 1907.

EDITORIAL NOTES—GAS, &c.

Rating Authorities and the Prepayment System.

IT looks very much as though the Ipswich Gas Company are going to have the honour of bringing about the final settlement of the contentious question between gas undertakings and rating authorities as to whether the expenditure on prepayment meters, stoves, and fittings should be treated as tenant's capital on which an allowance should be made. To those directing gas undertakings, it appears to be as clear as daylight that these things should be so treated; but the rating authorities are, of course, eager to transfer them outside the ruling and direction afforded by the case of *The Queen v. Lee*. It is contended by them that the case referred only to ordinary meters, and not to prepayment ones; and therefore, too, not to anything supplied by gas undertakings beyond consumers' meters in order to bring about a greater consumption of gas. In the Ipswich assessment appeal last year, the Recorder (Mr. T. C. Blofield) considered that the contention of the Gas Company upon this point was the correct one; but at the County of London Sessions, in the South Metropolitan Gas Company's appeal, the Chairman (Mr. Robert Wallace, K.C.) gave no direct decision on the matter, but intimated that, if he had to discuss, on all points, the proposition as to the inclusion in the tenant's capital of prepayment meters, stoves, and fittings, he should most respectfully dissent from it.

However, the matter has been advanced a stage from Quarter Sessions; and the concurring judgments, in the appeal of the Ipswich Union, of three Judges—Justices Channell, Bray, and Sutton—are favourable to the view of the Recorder of Ipswich and to that of gas administrations. While their Lordships decided that the question is one purely of fact and not of law, they did not shirk giving an answer to the case submitted to them, on the assumption that the matter was one of law and not of fact. Their answer was to the effect that, if the receipts arising from prepayment meters, stoves, and fittings were, in fact, brought into the accounts as profits in the gross profits of the business, then it was certainly right to include the expenditure upon them as tenant's capital in respect of which an allowance—not necessarily the customary 17½ per cent.—should be made. The remarkable thing is that, in view of the case *The Queen v. Lee*, there should have been any question regarding prepayment meters, as the addition of prepayment mechanism to gas-meters assuredly does not make such a vast distinction as to envelop them with an altogether different set of legal considerations; and, as to the stoves and fittings, the judgment confirms the correctness of the contention in placing them in the same category as meters. But it must not be imagined that the rating authorities will be content to leave the matter here; and the Ipswich Union have permission to take the question to the Court of Appeal if they consider it advisable to do so, though the concurrence of three Justices in a decision against them is not calculated to give them the greatest encouragement. However, in view of the large and increasing amount of capital invested in prepayment gas meters, stoves, and fittings, the decision—which was given without calling upon Counsel for the Gas Company to reply—is of immense importance to both gas undertakings and rating authorities; and, therefore, it may be practically taken for granted that there has not been by this decision a final disposal of the matter.

There is another point to which greater prominence has been given by the appeal, and that is the percentage allowance on tenant's capital. The customary 17½ per cent. for the moment appears to stand on a very insecure foundation. There is nothing binding about this particular percentage; it has only been accepted as a convenient percentage, following long-established precedent. Mr. Robert Wallace, in the South Metropolitan case, however declined to be bound in respect of it by the practice of his predecessor in the chairmanship of the County of London Quarter Sessions, and Justices Channell and Bray last week made it clear that, in their opinion, the 17½ per cent. allowance was where any grievance that the rating authorities might have was really concentrated. As we have said before, we say again, it is very convenient to have a definite percentage—17½ per cent. or any other fair figure—to apply in normal cases, so as to avoid useless litigation; and unless there is something extraordinary about a case, we cannot agree with the Chairman of the County of London Sessions that it is necessary to take the percentage into consideration in every instance.

A Menace to the Low Price of Gas at Widnes.

"THREATENED men live long," and we hope (making the necessary conversion) the same may be said in connection with the menace now hanging over the unique position of the gas consumers at Widnes in regard to lowness of price. But the maintenance of that position, it is manifest, will only be achieved by an active and determined movement on their part; and, while they are engaged on this defensive work, we suggest to them that it would be a good thing to put to the test the moot point as to whether the Council are not acting *ultra vires* in imposing the cost of the public lighting on the gas undertaking, as they have been doing for years—certainly since the incorporation of the town, now some fifteen years since. We will point out why the gas consumers should do this, after referring generally to what is now menacing their present position. On the Town Council, property owners are, it seems, in the majority; and naturally it is to the interest of the property owners, providing they are not considerable consumers of gas, to get the gas consumers to pay, through profits derived from their patronage of the gas undertaking, some portion of their rates, and thus produce a system of unequal taxation, against which we have long contended, and which, in our opinion, supplies one of the most cogent arguments against municipal trading. From that vicious system, Widnes has been in large measure, although not completely, free. But now, in the "Omnibus" Bill that is to be promoted by the Corporation in the next session of Parliament, a majority of the Council—despite the protest of Alderman Timmis, the Chairman of the Gas Committee, and a minority of the members—have succeeded in interpolating a clause which strikes at the protection given to Widnes gas consumers in 1867, and preserved to them ever since. By the Act of that year, the profits of the undertaking were only to be devoted to the purposes of the gas undertaking (including the provision of interest and sinking fund and the extension of the works). But, by the clause in question in the Bill before us, a majority of the Council are proposing to obtain authorization to appropriate any balance of income remaining, after providing for the working expenses and standing charges, for what is speciously described as "the relief of "the rates." The clause we cannot help regarding as most insidious and mischievous; for if it is allowed to stand, there will be nothing whatever to prevent the Council raising the price of gas, and maintaining it perpetually at a higher level, in order to ensure the contribution of a certain sum to the rates each year. The present Council may protest their innocence of entertaining any such suggestion; but the present Council cannot stand surety for the actions of their successors. We feel confidence in saying that so certain as the gas consumers allow the Council to do this wrong today, so certain is it that they will forfeit the enjoyment of having at their disposal the cheapest gas in the world. The door will be opened to a substantial upward movement of the price, given at any time a predominance in the Council of the class of men who argue that municipal undertakings were created for the production of profits for the community, or (we should prefer to put it) for the production of profits for councillors to squander. The clause in the Bill is a

huge mistake; for we contend, and seriously put it to the gas consumers, that cheap gas is a greater necessity for domestic and industrial purposes and for the general well-being than a problematical 2d. or 3d. in the pound off the rates; the actual relief being solely dependent on the restraint of the Council—present and future—in spending.

The right of the gas consumers of Widnes to maintain the present position is not by any means an unsubstantial one. They have both a legal and prescriptive right to that maintenance; but what title, from any point of view, have the ratepayers, *quâ* ratepayers, to participation in the profits? Who have consistently provided the interest and sinking fund on the gas-works loans?—The Gas Consumers. Who have provided all the money required for the extension of the works since 1891, amounting to some £79,000?—The Gas Consumers. Who have paid for the public lighting for the past fifteen years?—The Gas Consumers. Yet it is now proposed that part of the money earned by the gas consumers' own capital expenditure shall be appropriated in relief of the rates! Where is there a vestige of justification for this? When we look at the financial history of the Widnes gas undertaking (a financial history that has been made by wise administration by the Gas Committee and their executive officer, Mr. Isaac Carr), we can but treat as somewhat ludicrous sub-section 2 of the clause in question in the Council's Omnibus Bill: "Any deficiency in the gas-"works fund shall forthwith be made good out of the district "fund and the general district rate." What prospect of a deficiency is there with interest and sinking fund making such a comparatively light call upon the profits of the undertaking, and with all the difference between, on the one hand, the 11d. per 1000 cubic feet for power and the highest charge to private consumers of 1s. 3d., and, on the other hand, the statutory maximum price of 5s. per 1000 cubic feet before there could possibly be any call upon the rates? An excuse for the present proposal of the Council is not even to be found in Widnes occupying any unique position in having to devote, by statutory prohibition in other directions, surplus profits for the benefit of those who really produce them. In Scotland, the Burghs Gas Supply Act, 1876, will not allow excess profits to be made from the gas consumers; nor will Parliament in the case of Joint Boards in this country permit the making of surplus profits, and their utilization outside the undertaking; and there are instances where, outside districts being within the area of supply of a corporation, both gas and water have by parliamentary enactment to be supplied at cost price.

There is the other point as to the infliction of the cost of the public lighting of the town upon the gas consumers being in our opinion *ultra vires*. The old Act does not allow the Council to take money from the profits for the relief of the rates. But if putting the burden of the public lighting on the ratepayers is not a contravention of that restriction, we do not know what it can be called. We are quite aware that, at the time of the incorporation of the town, Counsel's opinion was taken on this point; and the opinion was to the effect that such a charge on the gas undertaking was permissible. But we have heard of Counsel's opinions not being upheld by Courts of Law; and we have heard of such things as the driving of a coach-and-four through an Act of Parliament. If the Corporation persist in going forward with this clause, we strongly advise the gas consumers, if they decide to oppose as ratepayers, to bring this matter before the first and if necessary the second Parliamentary Committee to whom the Bill will, by their opposition, be referred, as a direct flouting of an enactment of Parliament. The gas consumers have a good case. At the inauguration of the new gasholder at Widnes at the beginning of this year, we remember that Alderman Timmis stated that the public lighting was costing the undertaking about £2000 a year, or equal to 1·65d. per 1000 cubic feet of gas. We dare say, with the extension of public lighting since, the cost is now upwards of £2000, and equal to approximately 2d. per 1000 cubic feet, which means that, were it not for this impost, the department would be able to sell gas about 2d. per 1000 cubic feet cheaper than is now being charged. Anyway, since the incorporation of the town, the cost of the public lighting, and the compulsory relief thus afforded to the rates, must have represented at least £25,000 or £26,000; and now that the question of the disposal of the profits is being revived, someone may have to point out where the express authority of Parliament is to be found for taxing the consumers with this service, which is properly a charge upon the district fund. Reverting to the proposed appropriation-to-the-relief-of-the-rates clause, should it be passed, it will be an incentive not to keep the price of gas low, but to increase it in order to obtain surplus profits. In the protection afforded them by the Act of 1867, the gas consumers have a heritage which they should not lightly part with. It has served them well, and Widnes can want for nothing better from the gas undertaking than the service that it has had now for several years past.

The Subsidizing of Technical Literature.

TECHNICAL literature cannot be made a subject of philanthropy; but, in our experience of technical journalism, the methods adopted by Cassier's Company—anyway in connection with one of the special numbers of their magazine—suggest to us the introduction of something new, which it is to be hoped will not be perpetuated by any liberal support. Some time ago, the Cassier Company issued a prospectus of what was ycleped a "Gas Power" number of their magazine; and in that prospectus, they asked, "Do "you want to know all about the latest developments in gas "producers, gas and other internal combustion engines, gas "from blast-furnaces and coke-ovens, and *everything pertaining* "*to the use of gas as a motive power?* If you do, you cannot "do better than order a copy of the Special Gas Power "Number." We had that Special Gas Power Number under review in our issue for the 10th inst.; and it was then shown that, in one important respect, it was impossible to learn "everything pertaining to the use of gas as a "motive power." The one important respect was practically a complete omission of reference to the use of the small gas-engine, and to the successful way in which its employment is being fostered by the cheapening of town gas. So great was our surprise at this disregard of the small gas-engine, and what is being done to popularize town gas for motive power purposes, that the remark was made: "One "or two articles devoted to this subject would not have "been out of place, considering the enormous number of "engines using coal gas with most economical and satis-"factory results."

The truth, we think, is out. The articles constituting this special number were not intended to be articles in the ordinary sense of the word, but advertisements. The Cassier Company, it appears, canvassed gas undertakings for financial support, and evidently did not secure—from gas undertakings—what they deemed to be sufficient to make this special number what they had insinuated it would be, a comprehensive survey of contemporary developments in gas power, and everything pertaining to the use of gas for motive purposes. The value put upon an advertisement article in this special number by the Cassier Company was manifestly a big one. The article, it was suggested, would extend to about fifteen pages; and £10 was mentioned as a fair contribution from each gas undertaking. One gas undertaking actually promised £20; and we would suggest to the Cassier Company that perhaps some half-dozen others were also willing subscribers for £10 or less. And yet the fifteen-page article did not make its appearance. The Cassier Company found that gas directors and committees were not willing to finance technical publication in this way; and it was then suggested by the Company that support could be given by each undertaking purchasing (say) 100 copies of the magazine, or by subscribing to reprints. We can quite imagine, looking down the names of the writers of the articles in the special issue, that a considerable expense over the entire number would be incurred; but it must be remembered that, so far as the gas industry was concerned, it was only a question of an illustrated article, demonstrating the advantages of using town gas as a motive power, extending to fifteen pages! Supposing a hundred undertakings had been foolish enough to contribute £10 each, that would have represented £1000; supposing 200, that would have represented £2000; and so on. The abstention from any considerable support is apparently the cause of the bye-passing of town gas. If this is correct, we regret to see technical literature fallen from a position of independence, and made a matter purely of commerce. The revenue derived from advertisements and the sale of a journal or periodical should constitute an all-sufficient financing; and publicity to genuine technical, scientific, and industrial advances should be given without favour or condition. The making of publicity of the advances of the smaller types of gas-engines, and of what the gas industry is doing to meet the requirements of manufacturers for an ever-available

supply of good and cheap gas, conditional on financial support, reminds us—even if we cannot set it on quite the same low level—of the mercenary practices of certain financial papers in the reporting of the meetings of commercial companies. Some of those financial papers are prepared to sell body and soul at a price. The Cassier Company are, of course, at liberty to conduct their magazine as they like; but we trust that, if it is a common practice of that Company to which we have called attention, there will be a general refusal to subsidize them in this particular manner. There are numerous reputable technical journals in existence which reach all industries, and the publishers of which journals do not ask any payment whatever for the insertion of descriptive articles.

A Loss to British Science.

From the King down to the lowliest of his subjects who can appreciate the vastness of the benefits conferred upon mankind by the great intellectual gifts with which Lord Kelvin was endowed, there is general mourning over the loss of this, in our times, peerless *savant*. Excepting through his work on thermodynamics and certain of the instruments produced by his facile inventiveness which permit of the paths of research to be traversed with greater certainty, Lord Kelvin was not brought into direct contact with the gas industry. But he himself once said, there is a oneness about Science; there may be branches, but there is no definite division between one branch and another. Somewhere there is intercommunication. Just as this is true, so no man be he scientist or merely following some vocation in which the product of scientific thought and work has part, could fail to acknowledge Lord Kelvin the incomparable head and leader in the British world of science. He was intellectually great, his career was without compare, his thought appeared illimitable, his research profound, his invention based on sound reasoning, his achievement among his contemporaries without parallel. Honour and reward followed him in his activities. The wealth he bestowed upon mankind will be his imperishable memorial; the honour of it all greater far than the honour of sepulture among the mighty dead in Westminster Abbey. We all share in the great loss to Science; for though 84 years of age, and activity had had to be somewhat abated, the living influence of Lord Kelvin (apart from that of his accomplished work) had never lost its power. At the time of his death, he was the President of the Institution of Electrical Engineers, and a year of uncommon interest under his presidency had been anticipated by the members.

Franco-British Exhibition and the Electrical Interests.

Those who are moving in the matter of getting a British electrical section at the Franco-British Exhibition are having as much difficulty in arousing enthusiasm over it as have those who are occupied in a similar task in the gas industry. Dr. Glazebrook, late President of the Institution of Electrical Engineers, and Chief of the National Physical Laboratory, Mr. E. Cunliffe Owen, Mr. C. S. Northcote, and others have brought their eloquence to bear upon the electrical manufacturers; but, as far as can be traced, their pleading has fallen on stony ground. In urging the necessity for electrical manufacturers doing a part at Shepherd's Bush as well as at Manchester next year, certain things have been said about coal gas that should make those of the industry who read of them puff out with legitimate pride. It is "perfectly marvellous," we are told, how co-operation has forced gas—"our severest competitor in London"—to the front. The statement has also been made by Dr. Glazebrook, whose imagination has led to exaggeration, that (quoting the report) "it was also true, he believed, that the gas industry were to be represented on a *very large scale*. There was to be a collective gas exhibit to illustrate *as fully as possible* what could be done by them in lighting, heating, cooking, and so on." In the gas industry it happens that we do not yet know exactly what is going to be done; but it is fairly safe to say there is not going to be a gas exhibition at Shepherd's Bush so extensive as Dr. Glazebrook would lead those he desires to influence to imagine. So far as things have actually gone may be gathered by all interested electricians from our issue of Dec. 10; and it does not seem that anything beyond a popular demonstration of the uses of gas by certain London and Suburban Gas Companies will find its way to the Franco-British Exhibition. But reverting to the praise being showered on the gas industry to provoke the electrical manufacturers to action at Shepherd's Bush, the cleverness existing in our industry is brought into strong relief by a remark of Mr. Cunliffe Owen. Mark this: "With a bad cause, the gas companies have done wonders by co-operation." Brushing aside the compliment, we will say this on the question of co-operation: Certain of the Gas Companies of London and the suburbs, through the Gas Section Committee, have now approached the manufacturers on the question of an exhibition; in the electrical industry, it is the London Companies who are waiting for the manufacturers to approach them. At that rate, a British electrical section is not likely to get much "forrader." At the present time, the attitude of the electrical manufacturers is one of coolness towards the exhibition; and much the same can be said of the attitude of the manufacturers in the gas industry.

The Harris Cooking and Heating Company, Limited.

This is the title of a new Company the prospectus of which was issued last week; but we do not understand that it is the intention of the Company, as its title might be assumed to imply, to take in cooking or to undertake heating. The real purpose of the Company is to acquire the Harris patent grill and radiator, and to establish a business for their sale in this country. A capital of £30,000 is proposed; and the amount offered for subscription is £20,000, £10,000 of which it is proposed to allocate to the purpose of working capital. This is a big capital for a gas-grill and a gas-radiator which might well have been absorbed, as specialities, in an established gas-stove business. There seems to be a generous parcelling out of the proceeds of this promotion. The consideration to the inventor is £5000 in cash, one-fifth of the registered capital of the Company (£6000), and one-fifth of any increase in the nominal capital. The "promoter" is John Kidd; and we cannot satisfactorily trace what he has done to be so richly rewarded as is contemplated. He is to have £20,000, £5000 of which is to be payable in cash, £5000 in cash or fully-paid shares at the option of the Directors, and the balance of £10,000 in shares—the total of £20,000 including the cash and shares to be handed over to the inventor. We also see that John Kidd is to hand over 1000 fully-paid £1 shares to Mr. W. F. Jackson, who is a Director, and is interested in the promotion. Therefore two-thirds of the nominal capital is to be split up between inventor and promoters. The Directors have shown no disinclination to look after their own adequate remuneration for future services; and to their credit be it said they have not hidden the fact. We are afraid the promoters of the Company have taken a rather too rosy view of their prospects, about which they are unable to present anything of a really tangible nature, other than an initial order for 1500 grills. From whom the order has come is not stated; but if it were the subject of a "guessing competition," we should suggest Slater's Limited, seeing that Mr. Alfred Slater is the Chairman of the new Company. We will not pass the whole prospectus under review; but there must be protest against this statement contained in it: "It is well known that cooking by the ordinary gas stove and griller, particularly the latter, shrinks and dries the food, and that it is frequently affected by the fumes emitted by the gas." This, we maintain, is not well known; and it is not true.

Professional Audit of Municipal Accounts.

In spite of the fact that no legislative action has as yet been taken in the matter of the report, issued in 1903, of the Joint Committee on Municipal Trading—which, it will be remembered, was in favour of professional rather than official auditors being entrusted with the work of auditing the accounts of local governing bodies—there are already no less than seventy-five corporations who employ chartered accountants to do their auditing, which, one may agree with Mr. W. B. Peat, is a big step in the right direction. The occasion of the statement was a special meeting of the Bristol Society of Chartered Accountants, at which there was a long discussion on the subject of local accounts. Mr. Peat's views on the question of municipal trading are moderate in character. While, on the one hand, he does not in the slightest share in the alarmist view that corporations are "on their way to the Bankruptcy Court," on the other hand he admits that it is a far-cry from such concerns as tramways and gas and water works to the "thousand-and-one other things" municipalities are to be

found going in for; and he admits that the business of professional accountants, as agents, is to see that the accounts show the true profit or loss of the undertaking concerned. This, of course, is just the information which ratepayers are desirous of having, and which it is no more than right should be placed clearly before them, in every instance, without any exception whatever. The Chairman of the meeting referred to was Mr. F. A. Jenkins, who commenced his opening speech with a fling at what he chose to term the "irresponsible Ratepayers' Associations," who are "raising all manner of questions, and throwing suspicion, rightly or wrongly, on the acts of local authorities." Later on he remarked that in checking waste in little things, a Local Government Board audit might be beneficial, but it would seem to be of little effect in preventing heavy expenditure and excessive borrowing powers. How much work there is to be performed by the professional accountant under the same circumstances, will be apparent from the following catalogue submitted by Mr. Jenkins of the matters, "among others," with which such an auditor might intelligently deal: The construction of an income and expenditure account, instead of a mere receipts and payments account; the provision of a reserve for adequate depreciation in addition, when necessary, to the debt redemption fund; the allocation of expenditure between capital and revenue; the distribution of all expenditure in proper proportions among the various departments; the proper application of money raised by loans; and the clear and concise publication of all accounts, together with a full report to the ratepayers of all matters on which difference of opinion might arise, and which they might think it advisable to bring to the notice of the public. Is there anything here that any ratepayer would be likely to look upon as superfluous?

The Isolation of Joint-Stock Companies.

At intervals, we get a revival of the proposal that limited liability companies should be placed on the register of voters. As purely a question of justice, there seems to be no room for questioning the propriety of this course, in view of the considerable contribution that such companies have compulsorily to make to the local funds, but over the spending of which they have no power of control. The number of these companies that have no voice in the expenditure of the funds they so largely and increasingly provide, continues to ascend; and in recent years not only have their number advanced, but their individual payments in rates and taxes have grown considerably. Their isolation in all municipal matters but that of payment has no doubt been one of the causes of the degeneration in the class of men who (until mismanagement caused reaction) presented themselves for election to our municipal councils. For these and other reasons, we are glad to see that the City Corporation are bringing their position and influence to bear upon this matter, and are going to approach the President of the Local Government Board with a view to trying to persuade the Government to introduce a Bill to place limited liability companies on the register of voters. They are proposing to seek the co-operation of other municipal bodies; and they stand a better chance of gaining that now than they would have had a year or so ago. If they succeed in the herculean task of moving the present Government in this matter, what raving there will be in the neighbouring camps of Progressivism and Socialism. Some very interesting figures bearing upon this question have been issued by the City Corporations, and are reproduced in our news columns.

Workmen's Compensation Law.

After a period of comparative quiet, last week witnessed quite a crop of decisions on interesting points arising out of the operation of the Workmen's Compensation Act. First of all, there were four cases embraced in one judgment of the Court of Appeal, in which the point to be decided was the construction to be put upon sections 1 and 2 of the first schedule of the 1906 Act, in which provision is made for compensation to be paid on the basis of the "average weekly earnings" of the victim of the accident. The Master of the Rolls said that, in all cases in which accurate mathematical computation is practicable, the object should be to estimate the normal rate of remuneration. This was the main over-riding idea, to which every doubtful suggestion must yield. Days in which no work was done and no wages were earned, must be disregarded, except in the one case provided for in section 1 (*a*). As to the definition of "employment by the same employer" in section 2 (*c*), the language, he admitted, was obscure; but he understood it to mean that any step up or down from one grade to another was to be regarded as commencing a fresh employment. But in calculating any of the periods mentioned in section 1, they were to disregard absence due to illness or to causes beyond the control of the workman, and to reckon the employment as continuous. This would be only a presumption, which might be rebutted by evidence that the man was actually discharged on the ground of such absence, and subsequently re-engaged. Another case, also decided by the Court of Appeal, raised the question whether a man was killed "in the course of his employment" within the meaning of the 1906 Act. The deceased was travelling home from work in a train running under an agreement between his employers and the railway company, exclusively for the workmen, to whom no charge was made for travelling. There was no obligation on the men to travel by the train; and no difference was made in the wages of those who did so and those who did not. The County Court Judge found that it was an implied term of the contract of service that the trains should be provided by the employers and the men should have the right to travel in them free; and, this being so, the Master of the Rolls, and the other Judges of the Appeal Court, held that the employment began and ended when the men entered and left the train. It was, however, clearly pointed out that it by no means followed that every workman was entitled to the protection of the Act whenever an accident happened to him on his way from his home to his work. The remaining case, which is reported in the "JOURNAL" to-day, arose over the same words of the Act. One of the Sunderland Gas Company's workmen while engaged excavating a trench, found it necessary to leave his work, and for his own convenience went to his father-in-law's house some distance away, where he met with an accident and fractured his ankle. It was decided that this did not "arise out of or in the course of" his employment; and so the Company are relieved of any liability in respect to the accident.

Carbon Monoxide in Coal Gas.—At a recent meeting of the Paris Academy of Sciences, a communication was submitted on this subject by M. Léo Vignon. It showed that the larger the amount of oxygen in the coal, the greater is the proportion of carbon monoxide and dioxide in the gas obtained from it. At a temperature of 900° C., rather less than one-third of the oxygen of the coal is found, by experiment, in the gas in the form of these two oxides.

Award in the Wolstanton Arbitration.—Mr. A. J. Ram, K.C., the Umpire in this arbitration, the proceedings in which were reported in the "JOURNAL" a fortnight ago (p. 790), has made his award. The arbitration related, it may be remembered, to the purchase by the Wolstanton Urban District Council of the portion of the gas-works and plant of the Newcastle-under-Lyme Corporation lying within the Council's area, for which the Corporation claimed £36,866, including compensation for the loss occasioned by the severance of this part of the undertaking. For the works alone they claimed £7283. Mr. Ram has awarded them £6580.

Obituary.—We regret to announce the death, on the 12th inst., of Mr. Thomas Green, the Chief Accountant of the European Gas Company. He entered the service of the Company on Feb. 24, 1865, and, thanks to his assiduity and his conscientiousness, attained in 1881 the position of Chief Accountant, which he held to the end. The news of his death came as a shock to the staff, who looked upon him as one in the most robust health. Besides his duties as Chief Accountant in London, he made periodical inspections in France, where, by his quiet and unassuming demeanour and acquaintance with the French language and customs, he endeared himself to those with whom he came in contact. The staff lose in Mr. Green a good friend, and the Company a trustworthy servant.

The Examinership in Gas Engineering and Supply.—It may be remembered that in the "JOURNAL" for the 29th of October last it was mentioned that Mr. W. Doig Gibb, the Engineer of the Newcastle-upon-Tyne and Gateshead Gas Company, had been suggested to the authorities of the City and Guilds of London Institute, by the Council of the Institution of Gas Engineers, as a gentleman who would be suitable and willing to fill the vacancy caused by the relinquishment by Mr. A. F. Browne, of Vauxhall, of the position of Examineer in Gas Engineering at the expiration of his three years' term of office after the next examinations. We learn that at a meeting of a Committee of the Institute last Tuesday, the recommendation of the Council of the Institution (which was unanimous) was adopted. Mr. Gibb's appointment dates from the session 1908-9; and he will consequently prepare the questions that will be set for students in the examinations in the latter year.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 923.)

BUSINESS on the Stock Exchange gave evident signs of the approaching holiday; dwindling day by day to very modest proportions, which are not likely to be increased until the New Year. Though not quite settled from the start, it has been a favourable week on the whole. On the opening day, there was little change; but what there was was irregular—some going up and some going down, with no fixed tendency. The tone on Tuesday was scarcely so good, some realizing to close-down for Christmas having its effect; but actual movements were very slight. Wednesday was much about the same; but so little was doing that prices were quite inconsiderably affected. Thursday, however, brought about an improved tone, in some degree influenced by American affairs; and prices grew firmer. This was intensified on Friday, when the situation became quite cheerful. Consols and the gilt-edged division were on the rise; Americans were much better; and Home Rails were conspicuously improved. These brighter views continued through Saturday up to the close, unimpaired by profit-snatching; so the week ended very much more cheerfully than it began. In the Money Market, the supply was ample and rates were easy; but towards the close a strong demand for the usual seasonable requirements stiffened rates somewhat. Discount hardened during the week, and closed firm. Business in the Gas Market was irregular; some days being fairly brisk, and others very quiet. The general tendency was quite favourable; for though changes were few, they were in the right direction. In Gaslight and Coke issues, the ordinary was very firm—changing hands at 94¼ to 95¼. The secured issues were quiet and firm; the preference marking from 102 to 103, and the debenture 82 (a rise of 1 in the quotation). South Metropolitan was steady and unaltered; transactions being within the close limits of 120¼ and 121. The debenture was done at 82 and 83. In Commercials, a little more dealing was apparent, with transactions in the 4 per cent. at 102 and 103, in the 3½ per cent. at 98 and 99, and in the debenture at 80½. In the Suburban and Provincial group, Alliance and Dublin was done at 19⅜, ditto new at 13⅜, Brentford new at from 183¾ to 185½ (a rise of 1), British at 40 to 41, Bournemouth "B" at 16 15/16, Lea Bridge at 112, Southampton at 109, South Suburban at 114 and 114½, ditto debenture at 123, and Tottenham "B" at 102. The Continental Companies were very quiet. Imperial marked from 168½ free to 170 (a rise of ½), European fully-paid from 22½ to 23¼, ditto part-paid 16½, and Malta 4⅛. Among the undertakings of the remoter world, Ottoman changed hands at 6 3/16, Monte Video at 11⅛, Primitiva at 6 13/16 and 6⅝ (a rise of ¼), ditto preference at 5 1/16, River Plate at 13, and ditto debenture at 93 and 93½.

ELECTRIC LIGHTING MEMORANDA.

Illumination Exercises in the City.—Object Lessons in Street Lighting.—Lowness of Charge the Price of Advertisement.—Central Suspension v. Kerb Standards.—Minimum Candle-Feet.—Dissimilar Results from Observations.

THE City experimental electric lighting is giving electricians a little scope for outdoor exercise—photometrical and otherwise. The cost per nominal candle power per hour—the "*reductio ad absurdum*" of this public lighting question—has for the time being been forsaken. Now illumination tests and wonderful curves are taking the place of the old arguments in our electrical contemporaries; and we are invited to consider the general effect of public lighting in terms of minimum candle-feet—the attenuated results receiving expression to the first, second, and third place of decimals. But it is to be deplored that, with the remarkable refinement to which electricians prefer to work to prove their case, the results of different observers have a strange objection to harmonize, and conclusions are chaotic. But that is apparently a small matter, so long as the observations show rightly or wrongly that in minimum candle-feet the high-pressure gas-burners in Queen Victoria Street are not in the running. But still it is necessary that our electrical competitors should prove that flame arc lamps have something to be said in their favour, and that something is, in their opinion, now to be found in minimum candle-feet; and candle-feet and illumination curves can only be secured by the employment of an illumination photometer. Mr. Haydn Harrison is one of the observers; and, in the publication of his results in the "Electrical Review," he excuses himself for having made the tests by saying that "as the human eye, unaided by the photometer, is liable to be considerably misled when judging such matters, I have made a series of tests," &c. But we shall show by two sets of curves—the one published by Mr. Haydn Harrison and the other by "Electrical Engineering"—that the human eye, even aided by a photometer, is liable to be erratic in its estimation of illumination. But, after all, what matters the variable result? All this academical work of the electricians to prove the superiority of their illuminant for street purposes will be rejected as unintelligible by those who have the determination of such matters; and, as "Electrical Engineering" truly says, "the City Fathers will, in all probability, judge rather of the general effect of the lighting in the streets than from a study of photometric records." We agree. And what is it but the general effect as seen by the human eye, unaided by a photometer, that we want in street lighting? Fortunately for electric lighting, the photometer is not so often in the streets as the "human eye."

The opening lines of Mr. Haydn Harrison's article are very striking. He says "those who have had an opportunity of passing through the streets of the City of London, *at almost any time*, during the last few weeks will realize that they present an object-lesson in street illumination." The use of the words "at almost any time" makes the statement true, In the day time, when the streets are not shrouded in dense fogs, their illumination is as uniform as it is possible to get it. After sunset, the streets present a vivid object-lessson in patchwork illumination. In thoroughfares where the illumination is by swaying or fixed flame arcs, there is a great volume of light beneath the lamps, and a rapid falling off in illumination outside the highly favoured zone. Queen Victoria Street lighted by high-pressure gas-lamps is more uniformly illuminated. The lights have not the insufferable glare to be found beneath the flame arcs; they do not squander a lot of illumination 20 to 30 feet up in the air; they do not cast the sharp shadows found where illumination is the work of the flame arcs; nor do they cause the faces of pedestrians to look as if they are half-masked through the shadows cast by their hats. "At almost any time during the last few weeks." That includes the days of fogs, when our own observations pronounced in favour of the high-pressure gas-lamps. "Electrical Engineering," on the other hand, remarks: "There can be little doubt that the better general illumination given by the flame arc lamps, combined with the greater penetrative power of their rays through foggy atmosphere, is an advantage in their favour." Against this we call to witness the dense photograph of the flame arc lighting of Cannon Street in a fog published the other week in the "Electrical Times," and referred to in the "Memoranda" at the time (*ante*, p. 618). But it is "Electrical Engineering" that says "in spite of obvious advantages," central suspension "introduces difficulties in trimming and attending to the lamps; and it is urged by some critics that this position of the lamps is apt to be confusing in times of fog"—aye and dangerous, for in some of the recent dense fogs it was utterly impossible for drivers to properly distinguish where the sides of the roads ended and the kerb of the footway began. Kerb lamp-standards are guides to both drivers and pedestrians at such times.

Just as questions of efficiency under the worst conditions and reliability cannot be eliminated from the consideration of the means to be adopted for public lighting, so, too, cannot the important matter of cost. The pious hope is expressed by "Electrical Engineering" that the demonstration in the City "will effectually prove that the lighting of main thoroughfares by gas does not compare favourably, either in cost or effect." This is said in one part of the paper. In the editorial columns, we also find that "even in price, electric lighting will have a distinct advantage. This should be a matter of course." Why "a matter of course?" We see the answer in the next few lines. "Unfortunately, price is not always dependent on the cost of production, as other considerations tempt a company to light the streets of a corporation at a far lower price than they could afford to supply a similar service under conditions that do not involve a free advertisement of their method of illumination." Good! There are two competing Electric Lighting Companies in the City; and one cannot afford to let the other get any advantage over it. There is also a Gas Company there, some details of whose charges for the new street lighting we gave at the time a number of the old electric lamps were ousted from the public ways. Therefore we can well understand why it is "unfortunate" that the price for street electric lighting is "not always dependent on the cost of production." The £26-per-arc-lamp-per-annum days depart in the City as the contracts run out; and the Electric Companies cannot, as a point of policy, allow themselves to be eclipsed in the matter of price in the streets as well as in efficiency. We shall know more of how far they are prepared to go, without depending on the cost of production, in the future.

Now for the results of the illumination tests as expressed in candle-feet and graphically by curves. It may be mentioned that the lamps in Cannon Street are 11 ampere "yellow" flame arcs, suspended centrally over the roadway on wires, a method of suspension the disadvantages of which have been discussed on previous occasions. Those lamps hang 28 feet high; Cannon Street is 64 feet wide; and it is calculated by Mr. Haydn Harrison that the lamps average 46 to the mile. In Holborn, 10-ampere white-flame arcs are fixed on 20½-feet standards on the kerbs. Holborn is 82½ feet wide; and it is reckoned that the lamps are fixed at the rate of 40 to the mile. Then in Farringdon Street there are 6½-ampere white enclosed arcs on kerb standards 13¾ feet high. [Mr. Harrison states the height at 17 feet; so there is a little discrepancy here.] The lamps are spaced at the rate of 72 to the mile; and Farringdon Street is 99 feet wide. For comparison, it may be mentioned that the high-pressure gas-lamps in Queen Victoria Street are on standards 13 feet high; and they are (Mr. Harrison computes) spaced at the rate of 70 to the mile. The comparative narrowness of Cannon Street, in which the so-called "yellow" flame arcs are centrally suspended will be noticed. But against all the disadvantages of the central suspension, the electricians can only claim the one advantage (if such it is) that there are no columns required on the kerbs. It was supposed that the central lighting would result in a more equable illumination; but

that this is not so is seen by the curves for Holborn (kerb standards) and Cannon Street published in "Electrical Engineering." "It is interesting to note," says our contemporary in its comment, "the small difference between the average and, more particularly, between the minimum illuminations in the two cases." The same paper, in another place, states that the illumination from the centrally suspended lamps "would have been greater had it been practicable to place them closer to the ground, and, further on, adds "though the maximum illumination is less than in the case of lighting from lamps on the kerb, the drop from maximum to minimum is not so rapid." On the other hand, we have Mr. Harrison declaring that the lighting of Cannon Street is the best, as the minimum direct illumination halfway between the lamps exceeds 0·2 candle-feet, whereas in Holborn it is as low as 0·06 candle-feet, and in Queen Victoria Street 0·1 candle-feet. If we look at the curves in "Electrical Engineering," we see the minimum horizontal illumination along the centre of Cannon Street is 0·09 candle-feet, as against Mr. Harrison's 0·2 candle-feet for minimum direct illumination, and 0·16 candle-feet for minimum horizontal illumination. In Holborn the minimum illumination along the centre of the road is given by "Electrical Engineering" as 0·11 candle-feet, against Mr. Harrison's "as low as 0·06 candle-feet" for minimum direct illumination, and 0·030 candle-feet for minimum horizontal illumination. As we compare these figures, we are reminded once more of Mr. Harrison's words: "As the human eye, unaided by a photometer, is liable to be considerably misled when judging such matters," and ponder over what is much more true, how much the human eye aided by a photometer may mislead in discriminating the minimum candle-feet of illumination realized by different sources of light. If between two observers we can get the difference between 0·11 and 0·06 or 0·030 (Holborn) and 0·09 and 0·2 or 0·16 (Cannon Street), is it not likely that error, *plus* prejudice, may account for the minimum 0·1 candle-feet for the high-pressure gas-lamps in Queen Victoria Street? But it must be remembered that Mr. Harrison's figures show that the 0·1 for Queen Victoria Street is better than the minimum candle-feet for the arc lamps in Holborn and Farringdon Street; also that the 0·2 and 0·16 candle-feet for the Cannon Street lighting was obtained in a narrower thoroughfare, and that the latter figure is comparable with the 0·09 in "Electrical Engineering." Therefore it will be seen that if we make use of some of Mr. Harrison's figures and some of "Electrical Engineering," gas comes out on top. These are electrical illumination tests!

However, we have no great faith in the veracity of illumination street tests, particularly in connection with electric lighting. This view, it will be recollected, is supported by the "Electrician;" and it is at the present time interesting to call to mind what our contemporary had to say recently about this subject [see "Memoranda" for October 22 and November 5]. "What is really required," said the "Electrician," "is a definite illumination in the streets, and that such illumination shall not fall below a certain minimum at a point midway between any two lamps; and therefore that the variation of illumination from maximum to minimum shall not be excessive." Again, "there is some difficulty in making satisfactory measurements of low illuminations such as are likely to occur as minima." And, further, "a great deal of care is necessary in such measurements, because *an arc lamp is by no means a very steady source of illumination;* and therefore measurements, if not fairly numerous, might give results considerably above or below the actual time average." We have maintained in dealing with this subject that "definite" illumination cannot be obtained with arc lighting; that there is great variation (especially with flame arcs) between maximum and minimum; and that an arc lamp is by no means a steady source of illumination. These things may account for the considerable variations in the minimum candle-feet obtained by the two observers—Mr. Haydn Harrison and the investigator responsible for the curves in "Electrical Engineering."

Before concluding, there are a few points about the lighting of Farringdon Street. As already mentioned, 6½ ampere white enclosed arcs are used there. This lighting has been permitted, in order to let the City of London Electric Lighting Company show an example of lighting (says "Electrical Engineering") "at a less cost, and giving more illumination than that obtained from the gas lighting, and also without the glare of a flame arc." There is a little looseness about this statement. What is the cost of the electric lighting? What is the type of gas lighting with which comparison is made—low pressure, high pressure, or self-intensifying? And are we to understand that it was one of the reasons advanced by the City of London Electric Lighting Company, in seeking permission to light this street, that they desired to show a form of gas lighting "without the *glare* of the flame arc." "Complaints," it is said, "had been made of the glare of the flame arc, and the unpleasant effect of the white arc when not obscured, and every means appears to have been taken to obviate any trouble of this kind." Further, the lamps "give a clear illumination without harsh shadows; and the comparatively low intrinsic brilliancy of these lamps in the line of vision has the merit of enabling the even distribution of illumination to be more appreciated by the eye." We can take this as another serious electrical criticism of ordinary flame arc lamps and lighting, and leave it without comment. According to Mr. Haydn Harrison, the minimum direct illumination in Farringdon Street falls "as low as 0·04 candle-feet," and the minimum horizontal illumination is 0·010. In "Electrical Engineering" tests, the minimum horizontal illumination is given as 0·07. So, until there is greater conformity between illumination tests, it will be difficult to establish one's faith in them. We are still at a loss to know which form of electric lighting of the three with which experiment is being made in the City is most approved by our electrical contemporaries.

THE SALE OF ILLUMINATION.

The subject of the measurement and subsequent sale of illumination as such, rather than that of the luminant producing it, was referred to by Mr. Leon Gaster in his contribution to the proceedings of the Society of Engineers-in-Charge on the 11th inst. (*ante* p. 839). The author based his remarks upon a paper by Mr. E. Leavenworth Elliott, who has on various occasions evidenced his belief in the general accuracy of illuminometers so far as to suggest that the time was now practically ripe for the sale of illumination based on the results disclosed by these instruments. Mr. Gaster seems inclined to agree with him, but suggests that the method in which the measurement should be made, and the money value settled, is a matter for illuminating engineers to decide. It may be of interest if the salient features of Mr. Elliott's paper were brought to the notice of our readers. The contribution was made at the last annual meeting of the Empire State Gas and Electric Association; but on several previous occasions the author, as Editor of the "Illuminating Engineer," had taken opportunities of airing the notion. In recent issues of the periodical, editorial comments have been made upon the fact that the idea has not met with universal approval on the part of English contemporaries; and electricians have been singled out as the chief objectors! The attitude of the latter is not much to be wondered at, in view of the fact that illumination effect photometers do not particularly help in the advocacy of certain forms of electric lamps—the arc, for example.

In the paper referred to, Mr. Elliott states that the purchase and sale of light present a very curious anomaly in commerce, because the co-relative money value is not based upon a measurement of the thing itself, but on measurements of the commodity from which the light is produced; and he instances the case of gas light, remarking that it is the gas and not the light which is measured. With this view one must totally disagree, since gas has to possess a definite minimum candle power prescribed by the Legislature; and this is tested, or, in other words, measured, quite as much as the quantity of the commodity sold. The consumer therefore actually buys light—and, happily for him, he is enabled by the incandescent gas system to get much better value for his money than the law ever contemplated—and it is absolutely inaccurate to suggest that he simply purchases a luminant without any reference whatever to the illumination. The author generally in his paper appears to aim more particularly at electric street lighting; and it is therefore strange that the sale of electric current did not suggest itself as a good example for his argument.

Mr. Elliott remarks that light itself is not the ultimate thing sought—it is only a means to an end, which is illumination; and this, he suggests, is what an ordinary purchaser vaguely understands is being bought and paid for, because of the common practice of referring to bills for luminants as "lighting bills." He then proceeds to contrast with this a bill for coal, and says the buyer in this case is under no misconception, since the account is never spoken of as a heating or a "power bill." This is an odd remark; for if light is to be sold in foot-candles why should not the author advocate the sale of fuel as applied heat-units. One can imagine the plight of the coal merchant who has to charge according to the amount of physical heat which some fire-side student manages to absorb into his system during the course of a winter's evening. The author himself points to the difficulty when he says the illumination obtained from lighting commodities, or the energy from coal, depends on the method of usage. Mr. Elliott, dealing with the sale of illumination as such, confines himself to all intents and purposes to street lighting contracts; and he instances arc lamp lighting as a case where luminosity and illumination are confused in general practice. It is known that the light-giving power of the arc lamp is large; and it is therefore assumed that it is capable of illuminating a large amount of street surface, whereas the most casual observation shows that this is by no means the case.

The object of placing light sources in streets is to render things serviceably visible. But lights put up for this purpose are not paid for on a basis of the extent to which the purpose is accomplished; and frequently their money value is determined independent of any consideration of light whatever. Any method by which the final result—*i.e.*, illumination—can be measured and paid for should be a welcome innovation to both parties to the contract. Mr. Elliott, as stated by Mr. Gaster the other day, considers that such measurement can be achieved with sufficient accuracy as to afford a practical basis upon which to settle money values. He next discusses the question of the plane on which the illumination effect should be measured, and is in favour of the vertical plane as being in a sense a compromise between the normal and horizontal planes, and as having the most advantages and the fewest objections. The position of the testing plane should theoretically be on the pavement; but for convenience sake a point 30 inches above the ground could be taken. Then

comes the more important matter—that of the actual measurement of the illumination, which may be of (1) the maximum, (2) the minimum, (3) the average, or (4) that at a given distance from a lamp of some specified height. Mr. Elliott briefly discusses each method of measurement, and, while suggesting the minimum as having many points of advantage, is of opinion that measurement of the illumination at a given distance from the base of the light source is the best solution. This method, he adds, was also recommended by the Committee of the National Electric Light Association, who had the matter under consideration last year. The author recognizes the weakness even of this method, putting as it does a premium on freak illumination—that is, illumination concentrated on a given spot; but he thinks that the objection is of little force, since there are no available means of abnormally concentrating the light at an angle beyond 45 degrees.

Mr. Elliott, towards the end of his paper, says that the electric lighting interests have frankly admitted their opposition to the suggested method of measuring street illumination; but he remarks that this is only one side of the story. The public wants the best illumination for the money expended, and is quite unconcerned as to whether this is produced by gas or electricity, with arcs or incandescents, or what not.

The paper concludes with a statement that the payment for street lighting on the basis of illumination produced offers advantages to both buyer and seller; and a reform such as is suggested should be worthy of at least careful and serious consideration.

Gas and the Handicraft Trades.

The following remarks on the above subject appeared in the "Ironmonger" last Saturday: "More and more coal gas is supplanting coal and coke for forging and hardening the products of the old craft trades of Sheffield. Instead of the slow, dirty, and cumbersome coke-fired hearth, all kinds of hand tools, files, and knife-blades are now being treated for forging or hardening in neat and compact furnaces heated by town gas. Seeing that Sheffield owes its pre-eminence in cutting-tools chiefly to superior hardening, one can readily understand that the makers have long hesitated to change any of the methods which have produced such excellent results in the past in the direction indicated. Experience, however, has demonstrated that hardening by gas heat is quite equal to the older method, and as a consequence the innovation has made considerable progress during the present year. Apart from the advantages of quickness and cleanliness, the gas-furnace can be maintained more easily than any other hearth at a uniform heat. Not only is there waste of time in getting up the required heat in a coke 'hearth,' but after a couple of hours' working it is necessary to suspend operations and clear away the clinkers which have been formed. The hearth also occupies considerably more space than a modern furnace of equal capacity in which the tools are heated rapidly and the work goes on continuously. Town gas is remarkably cheap in Sheffield; but the credit is due to the officials of the local Gas Company. They appear to have initiated the changes; and in order to extend the use of their product, they have displayed commendable enterprise in experimenting upon the construction of gas-furnaces suitable to the needs of local trades. The use of gas for melting crucible steel is a change of method of older growth than that described above; but it, too, has not made much progress until the present year. Probably no important branch of industry has offered more stubborn resistance to the modern spirit than that which is concerned with crucible steel; but the adoption of plant for making gas and supplying it to the crucibles has necessitated considerable structural alterations in the furnace, and as a result the making of Sheffield crucible steel is now being carried on in an increasing number of cases in premises which are light, airy, clean, and convenient."

Condensation Reservoirs.—Mr. A. E. Carey, M.Inst.C.E., has written to the Editor of the Engineering Supplement to "The Times" regarding the possibilities of obtaining supplies of water from dew ponds. He says: "These ponds are familiar to those acquainted with the chalk downs. Many of them are of enormous antiquity, and are the handiwork of neolithic man. In some remote down districts, during long droughts, the extraordinary spectacle may be witnessed of villagers and farmers sending carts from the valley to the summit of the downs, in order to fetch water from dew ponds for domestic and farm purposes. The reason that these ponds do not dry up is that the radiation of heat from the earth at night is checked by a layer of non-conducting medium. The surface of the pond is thus chilled to the dew-point, and a deposition of the water vapour contained in the atmosphere takes place in the form of dew." To assist in the precipitation of water, Mr. Carey proposes to line the excavated reservoir with a special compound paving block so designed as to act as an effective non-conductor. In other situations artificial means may be taken to secure the conditions necessary to bring about a copious precipitation of dew. "As an instance of the utility of this system of water supply, it may be mentioned that a condensation reservoir, measuring 100 ft. by 100 ft., would, it is estimated, in the climate of the South of England, yield an effective volume of about 220,000 gallons of water per annum, or the equivalent to the domestic water supply necessary for a population of thirty or forty people. The first cost of an installation of this character is extremely low, and its maintenance involves no expense."

A GAS ASSOCIATION FOR CANADA.

We learn from the last number to hand of the "American Gaslight Journal" that a largely attended meeting of the representatives of Canadian Gas Companies was held in the King Edward Hotel, Toronto, on the 21st ult., for the purpose of forming a Canadian Gas Association. A correspondent of our contemporary says on the subject: "It has been felt for a long time that an Association of purely Canadian Gas Companies would be a great benefit to the industry in this country, and as a great number of companies are not interested in any existing Gas Association, it was decided to try to bring these different ones together, so as to foster friendly intercourse and promote commercial interests of members engaged in the business in the Dominion of Canada. The Hon. William Gibson, the President of the Hamilton Gas Company, was called to the chair, and, in a speech describing the object of the Association, he impressed upon those present the necessity of having an Association with a membership representative of the whole gas industry in Canada. If this first meeting is any criterion of the success of the Association, it will indeed be a grand one. As an initial meeting where so much preliminary work had to be dealt with and questions regarding organization thrashed out, it certainly gave great encouragement to those who had started the work. Letters were read from gentlemen unavoidably absent, and their hearty co-operation in every instance was expressed. It was decided to have both active and associate members. On nominations being called for, the following officers were elected: President, Mr. H. H. Powell, Brantford; First Vice-President, Mr. J. S. Norris, Montreal; Second Vice-President, Mr. J. Keillor, Hamilton; Secretary and Treasurer, Mr. A. W. Moore; Executive Committee, Messrs. Charles Forbes, J. C. Hay, W. C. Kennedy, W. H. Pearson, jun., and J. Philip. A very successful inaugural meeting was terminated in a hearty vote of thanks to the Chairman.

ACCIDENTS IN AMERICAN GAS-WORKS.

At the Meeting of the Michigan Gas Association last year, a Committee was appointed to submit a report upon accidents in connection with the gas industry. Circular-letters were sent to 44 gas companies in Michigan and 53 outside the State, requesting the following particulars; and 20 replies were received from the former and 13 from the latter.

1.—*Financial Loss by Accidents.*—An estimate of the loss your company sustained during the first six months of 1907 through damage by fire or explosion (*a*) to its own property, and (*b*) to property other than company's, but for which they were responsible. (*c*) An estimate of the loss sustained by accidents to property, machinery, &c., other than that caused by fire or explosion. (*d*) An estimate of loss sustained by injury to persons, both employees and others, for which the company were responsible.

2.—*Accidents.*—Give a brief account of any of the more unusual, important, typical, or common accidents which have occurred in your company, stating the cause, if known, and the nature of the accident. (Fires, explosions, personal injury cases, accidents to buildings, machinery, &c.)

3.—*Prevention of Accidents.*—(*a*) What precautions are you taking to prevent specific accidents and accidents in general in your company, such as fires or explosions, injury to persons shutting off gas supply, &c. (*b*) Give description and sketch, if possible, of any safety devices you may have in use.

4.—*Method of Treating Accidents.*—How do you proceed, when accidents happen, to protect the company from damage suits? Have you an adjuster? Do you carry accident insurance? Have you a company physician?

In the first group of particulars, the replies were as follows: (*a*) $115; (*b*) $3744; (*c*) $700; (*d*) $2868, but two serious cases were not settled at the time of the reply, and the loss was not known.

In the second group, the accidents reported were: Injured by machinery, 4; falls, 7; injured by tools, 4; gas asphyxiation, 5; burns, 2; horses, 1; gas explosion, 6; elevator, 5; nail in foot, 1; trenches caving-in, 3; collapse of floor, 1—total, 39, of which two were fatal.

In the third group, the replies were: (*a*) Careful instructions given to workmen; marine wiring, elevator gates, safety stops and elevator inspection, fire equipment, respirators. (*b*) No safety devices were submitted.

In the fourth group, the information furnished was: Companies having adjuster, 4; companies carrying accident insurance, 20; companies having physicians, 7.

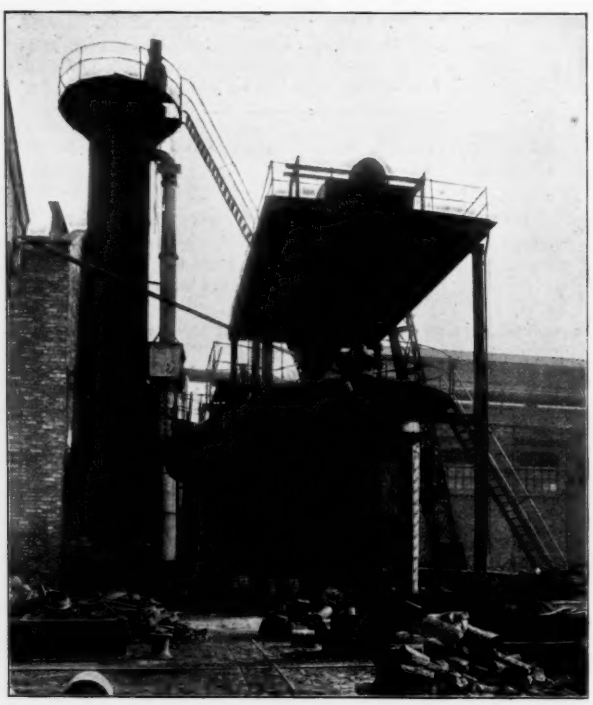
These replies were laid before the members of the Association at their last meeting, when the Committee expressed regret that the data and statistics on the subject of accidents were so incomplete, and that more companies did not reply. The Massachusetts Board of Gas and Electric Light Commissioners, reporting for the year 1906 on personal injury cases, where gas was responsible for the accidents, return 71 fatal cases and 90 serious but not fatal ones. Of the former, 32 were suicides. The New York State Commission of Gas and Electricity report for the past year, on accidents due to gas or explosion, 9 fatal cases and 33 serious but not fatal ones, besides minor accidents—number not specified. Suicide cases are not included in this report.

RECOVERY OF AMMONIA FROM GAS.

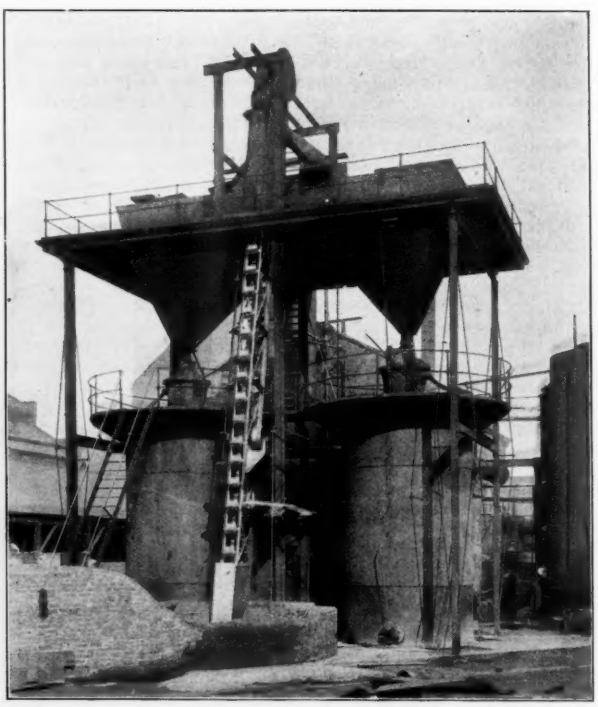
In the "Journal" a fortnight since (p. 760), reference was made to a scheme, for which parliamentary sanction will be sought next session, for the provision of electric motive power for Dublin and Central Ireland, the plant in connection with which will be driven by gas generated from peat, the operation to include the recovery of ammonia and other bye-products. In the course of the article, allusion was made to the paper read by Mr. Thomas Rigby early last year, before the Engineering and Scientific Association of Ireland, on "Power Gas Plants," in which the utilization of peat was advocated, and to some recent experiments in the production of gas and sulphate of ammonia therefrom. Some of our readers may remember that Mr. Rigby is associated with Mr. W. J. Crossley in a patent for the production of ammonia-recovery gas plants; an abstract of their specification having been given in the "Journal" for the 27th of August last (p. 579). In view, however, of the interest which will be aroused in what may be termed the secondary object of the abovementioned scheme, we reproduce from a pamphlet lately issued by Messrs. Crossley Bros., of Manchester, a few particulars of their new system.

It may be explained, by way of introduction, that three years ago Messrs. Crossley commenced to build producer gas plant, of a capacity of 36 tons of coal per day, for use in their own works; and that, after numerous experiments and researches with it, they developed the new system of ammonia-recovery plant, which they are constructing under the Crossley and Rigby patents. Their work in connection with the introduction of power-gas plants is well known; but it may be interesting to point out that since the year 1901, when they commenced to design and manufacture their own gas plants, they have conducted experiments with various fuels more or less continuously, and have frequently during this period made improvements in the use and application of gas-producing apparatus, chiefly for power purposes, but in a number of cases also for heating purposes, and have constructed during this time an aggregate of something like 200,000 H.P. in gas plants in sizes from 5 H.P. up to 4500 H.P. capacity.

In designing plants for the recovery of ammonia, it has long been well known that when bituminous fuel is subjected to superheated air and steam, with excess of steam, at a low temperature, a considerable porportion of the original nitrogen contained in all coals is present in the gas produced in the form of ammonia; and plants made with this object have been worked by a number of experimentalists. In order to make this process an economic success, it has been found necessary in practice to cool the gases leaving the producer to such a degree of temperature that a great proportion of the latent heat of the steam present in the gas is recovered. A portion of this heat is recovered by superheating the air and steam on their way to the producers. To obtain the remainder of the heat, together with the latent heat of the water



Ammonia Recovery Gas Plant, 3000 H.P.—Showing Producers, Superheaters, and Air-Saturating Tower.



Ammonia Recovery Gas Plant at Openshaw—Showing Producers, Washer-Condenser, and Sawdust Scrubber.

vapour present in the gases, it is usual to cool the gases and condense the vapour present in them by circulating water, which heat is afterwards recovered in an air-saturating tower.

Under the system which up till now has been employed for ammonia recovery, the gas after leaving the superheaters enters a mechanical washer, where it is cooled and freed from dust; leaving the washer at a temperature of approximately 90° C. It is then passed through an acid-tower, where, ascending through chequer-work, it is met by a stream of sulphate liquor containing about 4 per cent. of free sulphuric acid in its composition, the object of which is to absorb the ammonia present in the gases. Leaving the acid-tower freed from ammonia, the gas descends to the foot of a gas-cooling tower, the function of which is to cool the gases to a still lower temperature and condense the water vapour present in them. This is done by water, which is pumped up and circulated down the tower through chequer-work and in the opposite direction to the ascending gases. Leaving the cooling tower, the gas is taken away for use for either heating purposes or for further cooling and purification if for use for the production of power. The water leaving the foot of the tower in a heated condition is pumped to the top of a third tower, known as the air-saturating tower, where, descending again through the chequer-work, it is met by air from the blower on its way to the gas-producers; and the intimate contact obtained causes the water to be cooled and the air to be fully saturated with water vapour. The air, with its steam, is then passed on to the superheaters and gas-producers, while the remaining water is pumped back again and re-circulated through the gas-cooling tower. It will be seen from this description that in the existing process three towers and a washer are required for the absorption of the ammonia and the cooling of the gases. In addition, two sets of water-pumps and one set of acid-pumps are necessary for circulating the water and the liquor respectively.

By their improved arrangement, Messrs. Crossley have reduced the cost of the process very considerably. In the main, the new system consists in washing and cooling the gases, condensing the water vapour, and absorbing the ammonia in one and the same apparatus. The sulphate liquor circulated is used for the purpose of simultaneously saturating the air with water vapour and causing the liquor to be cooled for further circulation. After leaving the superheaters, the gas enters in the first place one of the compartments of the washer-condenser, where it is met by a water-spray made by a revolving paddle therein. The gas leaving the first compartment enters the remaining compartments in succession, where it comes in contact with a spray of sulphate liquor. The liquor in the bottom of this washer-condenser is moving in the opposite direction to that of the gas, and entering in the first place the cool end of the washer-condenser comes in contact with the gas leaving the apparatus. The next compartment the liquor enters is at a higher temperature, and so on till it leaves the compartment at which the hot gases enter, and is taken thence to an air-saturating tower arranged in the usual manner, where, being distributed down the chequer-work, and meeting air from the blower passing in the opposite direction, it is cooled,

and the air saturated with water vapour in the usual manner. The liquor leaving the foot of the tower flows back by gravity to the cool end of the washer-condenser for re-circulation and re-heating continuously.

It is found in practice that a spray of sulphate liquor obtained by this means is very efficient as an absorber of ammonia; and it is usual to obtain practically all the ammonia entering the washer-condenser as sulphate in the liquor. This result is claimed to be superior to the method of recovery used in the old process —*i.e.*, by means of a chequer-work tower. All that is required by the new system is a washer-condenser something similar to the washer used in the old process, and, in addition, one tower only and one set of pumps. It will thus be seen that two towers and two sets of pumps, with their connections and gas-mains, &c., are not necessary; so that not only is the capital cost of the installation considerably less, but the number of working parts and the wear and tear are much reduced.

In addition to an improved system of regeneration and ammonia extraction, Messrs. Crossley use a form of gas-producer, which has already been described and illustrated in our columns, which is considered highly efficient, not only in respect of the quality of gas produced, but also in the quantity of ammonia extracted. They find in practice that it is advisable to keep a constant quality of gas, as the yield of ammonia depends to a great extent on this; and they state that by the use of their patent gas-producer and system it is common to get a yield of 100 lbs. of sulphate of ammonia per ton of fuel gasified. From their experience with their own plant, they find it pays to have the ammonia-recovery apparatus when burning 100 tons of coal or upwards per week; but below this size its advantages are not so clearly felt. Although the ammonia is absorbed by free sulphuric acid to make sulphate of ammonia, this process does not involve any complicated or troublesome apparatus; and, to all intents and purposes, Messrs. Crossley find that the plant on their system is as simple to work as an ordinary power-gas plant. Their experience is that it is not necessary to have more than one-half of 1 per cent. of free sulphuric acid in the circulated liquor to absorb the ammonia fully; whereas in a chequer-work tower previously in use it was necessary to have from 3 to 4 per cent. of free sulphuric acid for complete absorption.

The foregoing particulars indicate the improvements effected by Messrs. Crossley in their ammonia-recovery gas plant, two installations of which (one being at their works at Openshaw) are shown in the accompanying illustrations.

A FRENCH RETORT-DISCHARGING MACHINE.

The Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, of Paris, have patented a machine for removing coke from gas-retorts. The following particulars in regard to it are taken from the patent specification, which has lately been published.

The discharging action is performed by bringing pressure to bear upon the coke; and the machine is applicable to through retorts of whatever length. Its special feature is that the pusher is constructed of several parts which slide upon each other, and are actuated successively by mechanism driven by an endless chain. In the accompanying illustrations, fig. 1 is a longitudinal vertical section of the machine, showing the constituent parts closed up; also a plan, and a transverse section, on the line X. Fig. 2 is a part longitudinal section, showing the position of the parts when extended; also a plan.

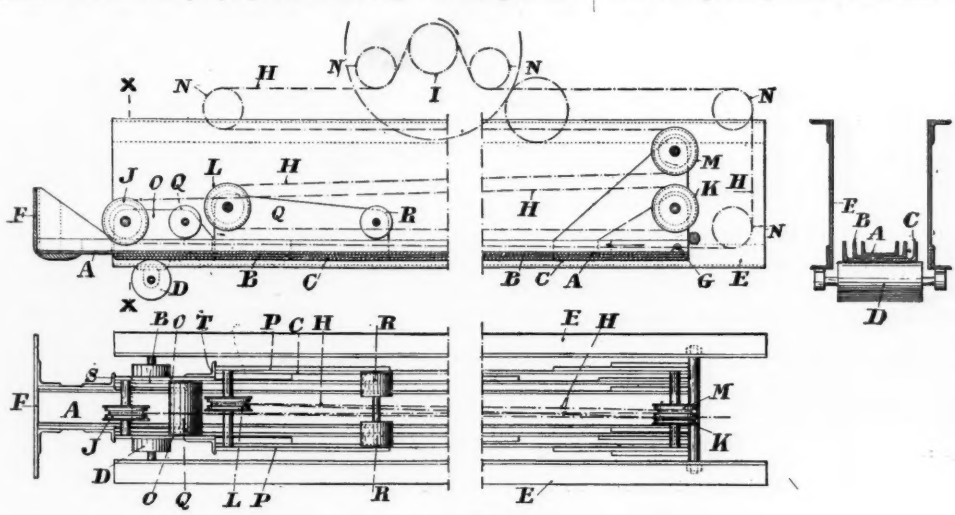


Fig. 1.

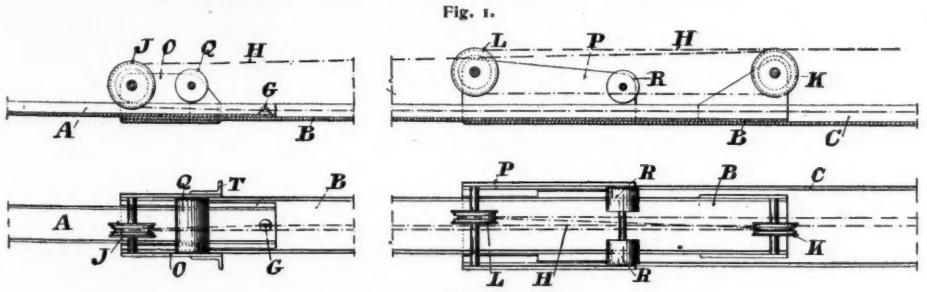


Fig. 2.

The machine is composed of several bars A B C so arranged that they can slide upon each other and at the same time be guided laterally. The lowest bar C rests upon one or more rollers D, mounted on the lower part of a beam E, which can be fixed upon a frame, and be combined with it in such a way that it can be moved vertically and horizontally along the front of the setting to serve all the retorts. The top bar A carries the pusher F, and is fastened behind, at G, to one of the links of an endless chain H, driven by a drum I, which is supported by the beam, and can be operated by hand or machine.

Taking fig. 1, and looking at the position of the endless chain H to the left of its point of attachment to the top bar, it will be noticed that the chain passes in succession over the pulleys J K, which are supported at the opposite ends of the middle bar B, and afterwards over two other pulleys L M, secured at the opposite ends of the bar C, and finally returns by means of the pulleys N fixed on the beam to the drum I. The brackets O P which support the pulleys J L also carry rollers Q R, which act as guides to the upper parts of the bars B C, and prevent them separating from each other when in action. At their front end, the bars A B are furnished with plates S T, against which the corresponding ends of the bars B C respectively impinge. On the front of the bars there are plates which combine with others fixed at the rear end of the bars A B to entrain these bars, one by the other, when they reach the end of their course.

The action of the machine is as follows: The movable frame-work carrying the beam is brought in front of the retort to be drawn, and the beam is raised sufficiently to allow the pusher to be exactly opposite the mouthpiece. On the drum I being turned in the direction of the arrow, it draws the lower length of the endless chain. This causes the top bar to move forward until its rear studs strike the front ones on the middle bar. Thereupon the chain acts upon the pulley K of the middle bar, and thereby moves the two bars together on the lowest one. As soon as the rear studs of the middle bar strike the front studs of the lowest bars (see fig. 2), it is itself moved forward with the other bars, owing to the stress of the chain upon the rear pulley M. Displacement of the lowest bar continues in consequence of the pressure of the chain on the guide-pulley N. By driving the chain in the opposite direction, the three bars will be run into one another, and will successively come in contact, at their rear ends, with a cross-piece on the beam. The patentees claim that the combined movements of the three bars, actuated by the chain, will give the necessary impulse to the pusher, and cause it to enter the retort and discharge the coke at the opposite end.

The late Mr. Basil Pym Ellis, son-in-law of Sir John Aird, Bart., and a partner in the firm of Messrs. John Aird and Son, whose lamentably sudden death in Paris was recorded in the "JOURNAL" for Oct. 8, left estate of the gross value of £207,385, of which the net personalty has been sworn at £190,037.

COAL DISTILLATION IN INCLINED CHAMBERS.

The setting shown in the accompanying illustrations has been patented by Herr Hans Ries, and it is the result of an endeavour to provide means of distilling coal in inclined chambers or compartments which can be charged from the rear. By means of the invention, it is possible to fill the chambers to the roof, and regulate their heating in such a way as to prevent, on the one hand, dissociation of the gas which collects in the upper part of the chambers, and, on the other, to produce a sufficiently intense heat without having inside the hearth channels for the hot gases. In the accompanying illustrations, fig. 1 is a longitudinal vertical section of the chamber on the line W of fig. 2, which is a transverse section on the line X of fig. 1. Fig. 3 is a longitudinal section of the upper part of the setting on the line Y of fig. 2; and fig. 4 a horizontal section on the line Z of fig. 3.

The inner part of the chamber A is raised at the upper portion of the roof B above its general line; there being in the roof, near the top, an enlargement C of the inner space of the chamber. A lateral charging-shoot D leads into this enlarged space, for the introduction of the materials to be distilled. Owing to the position of C at the top of the chamber, the latter can be completely filled with materials, which pass obliquely through the shoot. The space C, which serves at the same time as a collector for the gas, is connected by a rising pipe (not shown in the illustration) for taking off the gas. By a uniform heating of the sides and roof of the chamber, the space C attains the same temperature as the ends of the chamber; but there would arise the inconvenience of the heavy hydrocarbons in the gas being deposited on the heated walls of the collector. To obviate this as far as possible, the hot gases are conveyed away in the following manner: The adjacent chambers, to the number of three in the structure represented, are separated from each other by vertical channels E F, and the sides G H of the setting by vertical channels I J. Channels E I and F J communicate at the top by transverse channels K L in the roof. The channels, however, are formed only in the lower and middle part of the roof, as shown in fig. 1; whereas the lateral channels E F I J, near the top of the lid, communicate with channels N in the rear of the setting. This com-

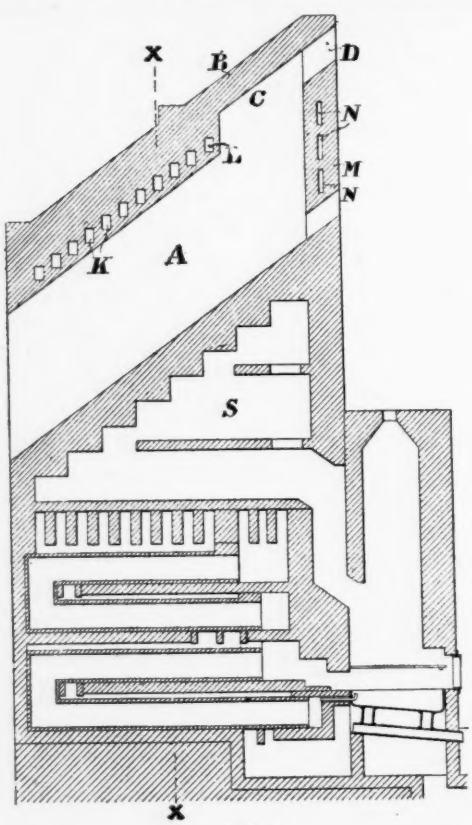


Fig. 1.

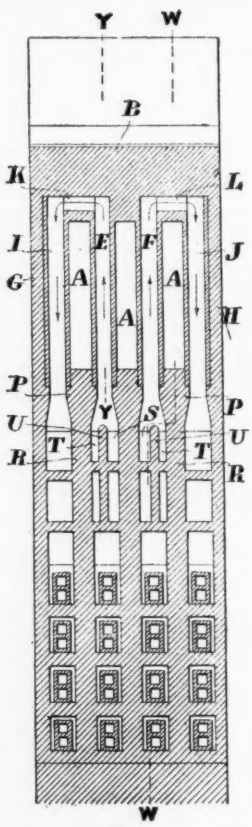


Fig. 2.

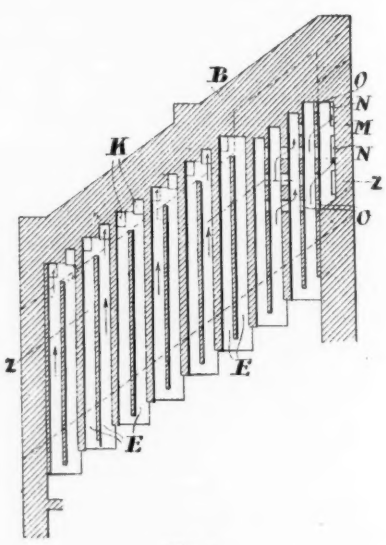


Fig. 3.

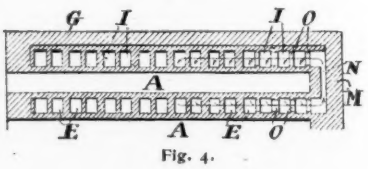


Fig. 4.

Ries' Inclined Chambers for Coal Distillation.

munication is established by forming in the intermediate sides at the upper part of the channels E F I J, near the space C, the passages O, which unite these channels with those in M (figs 3 and 4). By this mode of conveying away the hot gases, direct heating of the space C, and consequently the dissociation of the gas accumulating therein, is avoided. On the other hand, the rear end M of the setting is directly heated, so that the coal placed against this side is completely distilled. The sides of the chambers rest by their hearths P upon vertical columns R, which preferably run down to the foundations of the setting, so as to transmit to them the weight of the chambers as well as that of the materials inside.

Below the hearths forming supports for the chambers on the columns is the outlet of the hot gas channels S and the air channels T, running separately, the dividing wall U of which terminates immediately below the projection of the hearths. Thus combustion of the hot gases takes place in the lateral space near the hearths above the free extremity of the dividing wall, so that this point is the hottest place from which heat is transmitted to the hearth of the chambers. The result is that these are sufficiently heated without any necessity for heating channels inside, which would militate against the duration of the chambers. The air necessary for combustion, conveyed through the channels T, is preheated, by a regenerator placed at the lower part of the setting, by the hot gases from the channels I J.

The structural details of the setting may be changed without deviating from the principle of the invention. For instance, two or more rows of chambers may be superposed, so that the roof of one row constitutes the hearth of the chambers above; and any number of chambers can be placed side by side.

The Christmas number of the "Co-Partnership Journal" of the South Metropolitan Gas Company contains as usual an ornamental card conveying the wishes of the Directors that their partners—the great army of their regular employees—and all dear to them may have "A Happy Christmas." The centre of the card is occupied by a pretty representation of what is now called an "old-fashioned" Christmas. The scene is a farmhouse, with the village church in the background, after a heavy snowfall; and the surroundings include the holly, the bells, and the redbreast—the "sweet messenger, unheard in summer's flaring ray," so beautifully apostrophized by the Christian Poet—which are associated with the season of Peace and Goodwill. These words, as the Directors take the opportunity of pointing out, formed part of the song with which the first Christmas was heralded; and they express the hope that "these inestimable blessings will govern the relations between man and man and employers and employed in our country, and thus help to spread peace and goodwill in the world of industry." The effect of these happy relations, so far as the Company are concerned, is shown in a few figures appended to these remarks. They are as follows, and they may be left to speak for themselves: 5003 co-partners now hold £217,360 of stock, at a market value of £260,832; they have on deposit at interest, £58,295; and invested in the purchase of houses, £28,600—making a grand total of £347,727. This works out to £69 10s. for each co-partner; or, excluding the officers, about £50 per man.

RADIO-ACTIVITY OF COAL GAS AND SPENT OXIDE OF IRON.

In the current issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company, the above subject is briefly dealt with by Mr. C. J. Dickenson-Gair, of the Company's Vauxhall station, whose paper on the "Estimation of Naphthalene in Coal Gas and Spent Oxide," read at the last meeting of the London Section of the Society of Chemical Industry, was noticed in the "JOURNAL" for the 10th inst. (p. 770). The following is Mr. Gair's article.

While thinking about some experiments which seemed to show radio-activity in coal, the question occurred to me: If coal has sufficient radium or other radio-active substance in it to discharge an electroscope, why should not some, if not all, of it, in the form of emanation, be driven off when coal is heated in retorts to something like 2000° Fahr.? It is also a well-known fact that radium or thorium, when heated, gives off radio-active emanation* with extreme rapidity, so it seemed more than likely that we should find it in the gas itself. To see whether this was so, experiments were tried with a delicate graduated electroscope. It was necessary, in the first place, to find how long it took the aluminium leaf to fall, by leakage, one degree. This was found to be exactly 45 minutes. A gentle stream of purified coal gas was now allowed to play on the copper receiver of the electroscope, and the time of deflection of the leaf again noted. It took only 30 minutes. The gas leaving the hydraulic main was now tried, and the deflection only took 16 minutes. Evidently the gas had been losing radio-activity, or something kindred to it, between the condensers and the holders. It appeared likely that the oxide might be arresting it; and experiments seemed to show that this indeed was the case. A small lump, weighing 3 grains, of the spent oxide, eight hours after leaving the boxes, when placed one-fifth of an inch away from the receiver, deflected the leaf one degree in 14 minutes. New oxide of the same weight and at the same distance had no effect at all. Moreover, it is just possible to see faint scintillations from spent oxide on to a zinc sulphide screen in the dark, if a twenty diameter magnifying glass is used. Mr. H. C. Sims, jun., can corroborate these results, and many more check tests.

* Thorium emanation only lasts about one hour. Radium emanation is still strongly radio-active after four days; and spent oxide of iron is still radio-active after at least two days.—C. J. D-G.

PHOTOMETRY OF INVERTED BURNERS.

In the course of an article recently printed in the "Journal für Gasbeleuchtung," Dr. Hugo Krüss and Dr. Paul Krüss, both of Hamburg, describe some new forms of supports for holding inverted burners during their photometric examination at various angles with the horizontal, proceeding afterwards to explain the method by which the actual readings obtained on the photometer may be easily converted into mean spherical or mean lower hemispherical illuminating power. Appliances intended to hold a gas-burner in such varying positions that its emissive powers at different angles may be measured, have already been designed by numerous authorities; but they were principally intended for employment with upturned burners. Some of them, however (such as the stands described by the present authors about nine years ago, and also that adopted by Professor Drehschmidt more recently*), readily lend themselves to modification and use with inverted burners.

A convenient form of stand for the optical investigation of small inverted burners—*i.e.*, such as take mantles presenting to the observer not more than some ¾ inch of glowing surface, is shown in fig. 1 herewith. It consists of a massive upright iron ring having at the apex a depending rod which is branched at the base so as on one side of the ring to support a stiff horizontal bearing X, and on the other side to carry, at T, the supply pipe conveying gas to the burner, and the burner itself under observation. The rack and milled head on T enable the burner to be set at the proper height to ensure alignment between the rays of light and the axis of the photometer bar. The bearing X carries the optical system of three mirrors, S_1, S_2, and S_3. The centre of S_3 is concentric with the centre of the spindle, the horizontal axis of the latter coinciding both with the centre of the photometer screen and with the central point of the light B. The mirror S_1 is supported at an angle of 45° with the horizontal when the system hangs as shown by the diagram, and is ready for the measurement of vertical rays. It, therefore, reflects the light falling upon it from the mantle on to the centre of S_2, whence the rays are reflected at right angles a second time upon S_3, by which they are reflected a third time into the main axis of the photometer. As the whole system of mirrors revolves without displacement about the spindle X, the rays issuing at any polar angle from the mantle are ultimately reflected into the same horizontal line. At one end of the collar on X is a graduated disc K, worked by a milled head; and over it a pointer travels showing the angle formed at any position of the mirror train between the horizontal plane and the line passing from the mantle to the centre of the mirror S_1.

* See "JOURNAL," Vol. XCII., p. 175.

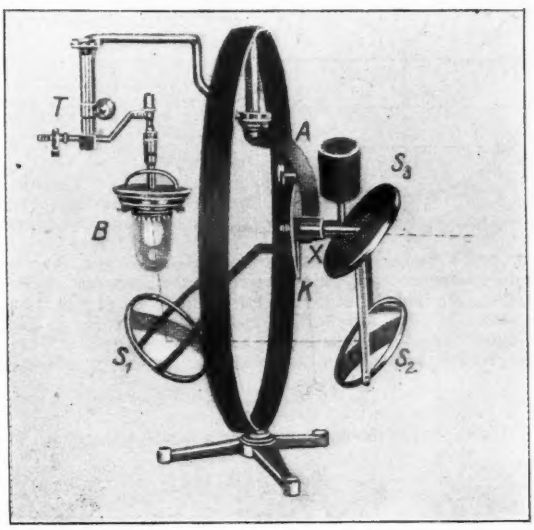


Fig. 1.

The foregoing stand is not large enough for the investigation of inverted burners when completely fitted with globes and shades, as mirrors up to 10 inches in diameter are requisite for the purpose. The apparatus shown in fig. 2 is therefore preferable. The latter stand is carried on a very rigid cast-iron base with a levelling screw at the back, by means of which the path of the rays of light finally quitting the mirror S_3 may be adjusted accurately into a direction coinciding with the longitudinal axis of the photometer. All parts of this second stand are lettered in the illustration in the same manner as those in fig. 1; and therefore a verbal description of the whole is unnecessary.

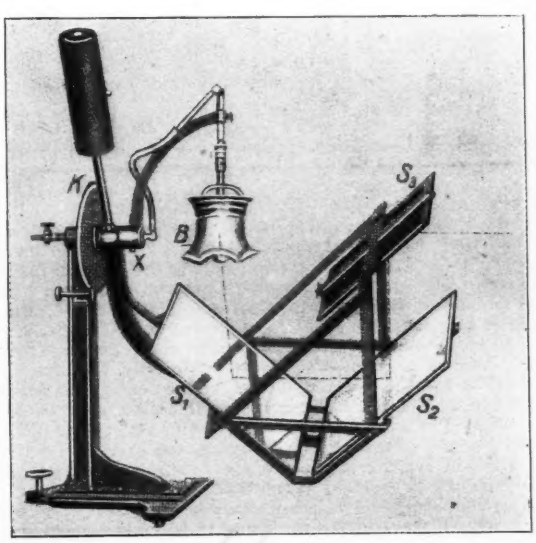


Fig. 2.

When these stands are used, it will be noticed that, before assuming their ultimate horizontal path, the rays of light travel over three sides of a rectangle in the direction B, S_1, S_2, S_3. Hence the virtual distance of B from the photometer screen is greater than its actual direct distance by the quantity $BS_1+S_2S_3$, or, in other words, by twice the distance BS_1. If therefore, the ordinary graduations on the photometer bar are to be used, the stand must be erected thereupon in such a position that the central vertical axis of the burner is nearer to the screen than the zero point of the scale by a distance equal to the total length $BS_1+S_2S_3$. The loss of light due to the imperfect reflecting powers of the three mirrors may be eliminated from the results by determining once for all the difference in the amount of light received on the screen from a burner of constant illuminating power when that burner is tested at a given distance from the screen on the stand, firstly without, and secondly with, the optical system of three mirrors; the mirrors being arranged to reflect horizontal light.

Calculation of the Results.

In the article by Dr. H. Krüss, an abstract of which was published in the "Journal" on Dec. 10 (p. 777), practical methods were described for converting the readings obtained during the photometry of burners at different angles into mean spherical or mean lower hemispherical candle power. It will, however, be convenient to reproduce part of that calculation and to append a table of the trigonometrical data needed. The vertical circle in fig. 3 indicates the phenomena under observation when the rays of light issuing from a source at A in the directions AC, AD, &c., are measured throughout a complete quadrant. In the diagram and subsequent equations, the angle CAD—*i.e.*, the angular distance between each successive set of photometrical readings—is termed β; and the angle formed by the line EA (which bisects the angle CAD) with the horizontal is termed α. Now, on studying the equations given in the former article (see "Journal," *loc. cit.*), it will be found that the mean spherical illuminating power is

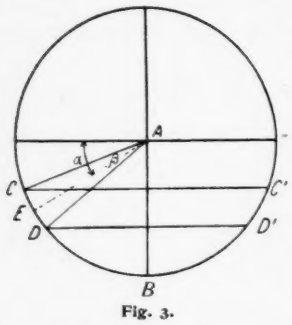


Fig. 3.

$$I_0 = \sin \frac{\beta}{2} \Sigma I_\alpha \cos \alpha,$$

and that the mean lower hemispherical illuminating power is

$$I_\supset = 2 \sin \frac{\beta}{2} \Sigma I_\alpha \cos \alpha.$$

In the following table are collected the various values for cos α, which will be required in converting the readings into spherical candle power as the angle α increases by units of either 10° or 15° with the horizontal—that is to say, as the angle $\frac{\beta}{2}$ is either 5° or 7½°.

$\beta = 10°$		$\beta = 15°$	
$\sin \frac{\beta}{2} = 0{\cdot}0872$		$\sin \frac{\beta}{2} = 0{\cdot}131$	
α	cos α	α	cos α
5°	0·996	7½°	0·991
15°	0·966	22½°	0·924
25°	0·906	37½°	0·793
35°	0·819	52½°	0·609
45°	0·707	67½°	0·383
55°	0·575	82½°	0·131
65°	0·423		
75°	0·259		
85°	0·0872		

Gas-Firing in Potteries.

On Monday last week, Dr. R. L. Seligman, who has made a special study of gas-firing, delivered an address at the monthly meeting of the English Ceramic Society in the Victoria Institute, Tunstall. He said that in considering the utilization of gaseous fuel the most interesting point was the reduction of fuel consumption. The manipulation of a gas-jet was so much simpler than the correct stoking of a direct fire, that much greater accuracy could be demanded of the fireman. Secondly, the regular rise and fall of temperature in the oven and the freedom of the flames from ash and dust effected a great diminution in the breakage. The loss of saggars, for instance, might be reduced 50 per cent. by the adoption of gas firing. No great economy, however, could be attained by the introduction of such firing unless steps could be taken to recover the heat lost in the escaping products of combustion. This might amount to close upon 60 per cent. of the fuel supplied to the kiln. If, however, instead of using this waste heat for heating the air, it was employed for "smoking" and heating up the ware which was about to be fired, a further reduction in fuel consumption might be attained. In addition, it was possible by the adoption of gas firing to utilize the heat left in the ware when the fires were drawn. This was effected by passing the air required for combustion over the cooling ware. By the adoption of this device the fuel consumption might be reduced by 66 per cent., and the efficiency raised to upwards of 60 per cent. Such results as these were actually attained by the furnaces in use on the Continent. They could get fire-bricks there which would stand where no English bricks he knew would do so, and these were also fired with gas. But he thought in Germany they were more careful in the manipulation of their clay than we were in England.

We regret to learn that Sir John Aird, Bart., who was taken ill some weeks ago, but recovered sufficiently to be removed to his residence at Wilton Park, Beaconsfield, has recently had a bad relapse.

THE RELIABILITY OF GAS-ENGINES.

At a well-attended meeting of the Coventry Engineering Society last Friday, Mr. A. Vennell Coster, of Messrs. Crossley Bros., Limited, gave a greatly appreciated lecture on the subject of "The Reliability of the Gas-Engine."

Mr. Coster began by pointing out that the advent of the gas-engine as a commercial prime-mover was at the present time affecting in an increasing degree the commerce and trade of the civilized world. As evidence of the strides that have been made, he mentioned that gas-engines are now being built of more than 800 B.H.P. units in two cylinders, or 1600 B.H.P. units in four cylinders, driven by producer gas. In Germany there were, he said, many firms building large gas-engines, up to 4500 B.H.P. maximum, most of them being for use with blast-furnace or coke-oven gas. In connection with the question of economy to be obtained by the adoption of large gas-engines driven by such gas he gave figures showing that in a German iron and steel works the introduction of gas-engines had reduced the cost of fuel by 4s. 2d. per ton of iron during the process of conversion into steel and rolling.

The lecturer went on to say that one of the great tests of reliability of gas-engines was the non-stop continuous test. Engines were now regularly supplied which would sustain a non-stop run night and day from early on Monday morning to late on Saturday night. At Messrs. Brunner, Mond, and Co.'s works at Northwich, he saw one of these engines of about 120 B.H.P. driving a dynamo which never stopped running night and day for upwards of seven months; and he knew of many large engines running from one to three months in a similar manner. Personally he was not in favour of such long periods of running. A full week should be ample to meet the demands of almost every kind of manufacture. It was a decided advantage to let the engine have a rest, to have the valves overhauled and the lubricating arrangements and fittings adjusted so as to keep everything in perfect condition. Gas plants, whether of the suction or the pressure type, were designed to undertake the supply of gas for long periods without rest, and to maintain their economy and efficiency under all circumstances. Mr. Coster cited the annual report by Mr. Michael Longridge, the Chief Engineer of the Engine and Boiler Insurance Company, and noticed in the last volume of the "Journal" (pp. 754, 838), to prove the remarkable advance in reliability that the gas-engine has made, inasmuch as in his analysis of breakdowns this engine showed to better advantage than the steam-engine. One of its great advantages over the latter engine was the reduction in stand-by losses, which were quite 75 per cent. less than those of the steam-engine.

In describing the important development in the use of gas-engines which has taken place recently in America for driving high-pressure pumps for supplying water at the working pressure of 300 lbs. per square inch for extinguishing fires, the lecturer said this spoke well for the reliability of the gas-engine, as there was no service that required such absolute certainty as methods for coping with large city fires. The internal combustion engine was also, he said, used largely in connection with lighthouses. Liquid fuel was usually employed for this class of work, and the record for reliability was beyond question. Great improvements had also taken place during the past few years in the design of governors, so that the gas-engine could now undertake any duty that had been considered possible only with a first-class, high-speed steam-engine. Where economy in gas consumption was of primary importance, none of the present-day elaborate methods of governing had yet beaten the "hit-and-miss" arrangement, which was simple, easily understood, and ensured the best economy, and when carefully designed need not be attended with either noise or wear and tear; and for engines up to 250 B.H.P., Messrs. Crossley had retained this method of governing. For vertical multi-cylinder engines, a method not so economical, but one which could govern all cylinders by one piece of mechanism, known as the "throttle" governor, was very largely adopted by most makers, and could be recommended for this type of engine.

Turning to the subject of thermal efficiencies, the lecturer thought it might be safely assumed that of the total heat in the coal the gas-engine turned into actual work about twice as much as the best steam-engine. Analyzing the losses in a gas-engine plant, it was found that the producer of the present day had a heat efficiency of from 80 to 90 per cent., and that the gas-engine had an efficiency of from 33 to 35 per cent.; so that of the total heat in the coal about 25 per cent. was converted into actual work. Mr. Coster described the different standard types of producer-gas plants, and claimed that with anthracite at 21s. 4d. per ton the cost of fuel per brake horse power was 0·1d. per hour. In regard to oil consumption, he said this depended altogether upon the intelligence of the engineer in charge. The two main points to watch were correct and economical distribution, and the running of all oil possible into a filter-tank for use again and again. From particulars supplied by Messrs. Cadbury of the oil consumption of their gas-engine plant for twelve months, it appeared that, taking the average price of oil at 1s. 8d. per gallon, the cost worked out at 1·7d. per B.H.P. per week of 72 hours.

The lecture was followed by an interesting discussion, during which questions were put as to starting. Mr. Coster replied that the difficulties in this respect were met by the use of compressed air self-starters, particularly for large engines; but in many cases

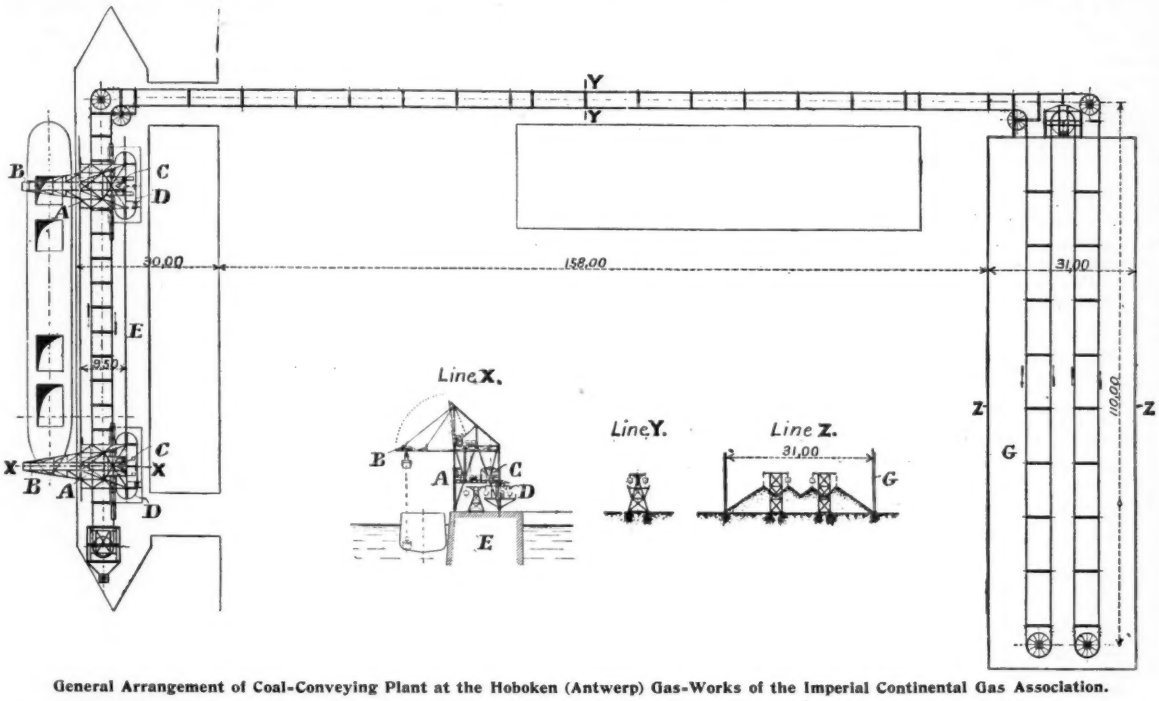
of small engines there would be no difficulty, if attention were given to the supply of gas and the proper colour of the ignition flame. He also drew some interesting blackboard diagrams to explain the timing of the explosion and the interval necessary to allow between the contact of the gas with the ignition and the actual explosion, and also the positioning of the exhaust-valve, so as to prevent any of the free gas escaping before this closes. The Chairman (Mr. J. V. Pugh) spoke very highly of the instructive character of the lecture, particularly with regard to the engines of higher power; and Mr. Coster was accorded a hearty vote of thanks.

MODERN CONVEYING PLANTS FOR GAS-WORKS.

The Imperial Continental Gas Association are using strenuous endeavours to fit up their establishments with modern transport appliances; and, after successfully installing an extensive plant for the conveyance of coal at the Mariendorf Gas-Works, near Berlin, they have now a plant in course of erection for their Hoboken Gas-Works, near Antwerp. The fundamental principles are the same in both cases—namely, a combination of cranes and wire ropeways; but both general arrangement and details are carried out differently.

Two travelling cranes A, furnished with raisable jibs B, which operate with a rope-grab having a content of 1·6 tons, hoist 50 tons of coal each per hour from the ships. The coal is thrown into hoppers C, built into the frame-work of the cranes, and drawn off into the wire ropeway cars. A loading switch D, stretching across the track of the wire ropeway with slide rails, is (together with the coupling and uncoupling appliances thereto) firmly attached to each crane, so that the cars can be stopped at the crane or forwarded as the case demands.

The wire ropeway has a capacity of 100 tons per hour. It runs between the portal crane supports along the pier E and past the retort-house F to the coal-shed G, which is traversed by four lines, separated from one another by distances of 5 metres



General Arrangement of Coal-Conveying Plant at the Hoboken (Antwerp) Gas-Works of the Imperial Continental Gas Association.

—thus permitting the depositing of coal over the whole area. With the system employed, attendance is only required on the cranes which are actually working—viz., one man to load the cars and one mechanic. In addition to this, the striker in the coal-shed must be moved from time to time, although in other respects the plant acts perfectly automatically, as the cars take all curves without disengagement from the rope. In case of traffic interruptions, the ropeway can be stopped immediately from each crane by means of a simple switch.

The entire plant is being built by the firm Adolf Bleichert and Co., of Leipzig and London, who also supplied the conveying appliances for the Mariendorf Gas-Works.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

Visit to the Stirling Gas-Works.

Last Saturday afternoon the members of the Western District Section of the Scottish Junior Gas Association, to the number of between thirty and forty, paid a visit to the works of the Stirling Gas Company. They were received by Mr. James Johnstone, the Chairman of the Company, and Mr. J. D. Smith, the Engineer and Manager. As the works were described on the occasion of the inauguration of new plant in them quite recently (see "JOURNAL" for Sept. 24), it is not necessary to deal in detail with what the visitors saw. The attraction for them was the coal-handling plant, particularly the machine for charging and drawing the retorts, which is that of Messrs. Robert Dempster and Sons, Limited, of Elland (Toogood's patent). Mr. J. W. Broadhead, the representative of that Company, explained the plant, which was kept working for the benefit of the visitors. He stated that it had now been in use for five months, and it had given the utmost satisfaction. No difficulty had been experienced, at any time, in putting in perfectly level charges, from end to end of the retorts, which are 20 feet throughs, and also in varying the charges from a minimum of 5 cwt. to a maximum of 10 cwt. At present, five hours are allowed for each charge; but three-hour charges have been employed. The charging, as was illustrated practically, is done in 14 seconds, and the discharging in 18 seconds. In the discharge, the coke invariably comes away without any buckling. The visitors were impressed with this feature of the working, and also with the quickness and ease with which the coke was pushed out, as well as by the fact that there was no spilling of coal at the mouthpiece when charging, nor any coke drawn back by the discharger at the end of the push. Mr. Broadhead explained that electric power had been adopted for the working of this plant in every machine made, but that Mr. Toogood had invented, and Messrs. Dempster had obtained provisional protection for, an arrangement in which an endless cotton rope was used for the working of the machine—the motive power being either a steam or a gas engine. In this new arrangement, by the ingenious combination of rope pulleys and epicyclical train gearing-wheels, the machine was operated so that one handle would give either a forward or a reverse motion, or leave the machine standing free—no clutches being required. The visitors looked over the works, and then adjourned to M'Alpine's Temperance Hotel, where tea was served—Mr. Johnstone in the chair.

The CHAIRMAN expressed the pleasure of the Gas Company in receiving the visitors, and said he hoped they had seen something which would benefit them. The introduction of the plant they had inspected had been a great success. It worked splendidly; and they had been very much satisfied with it.

The PRESIDENT (Mr. W. Wilson, of Falkirk) desired, on behalf of the Association, to convey to the Directors of the Company their sincere thanks for the privilege which had been extended to them, in permission being granted to go over their works, and inspect the recently introduced stoking machinery and carbonizing plant which embraced the most modern practice in the carbonizing department of a gas-works. They were delighted with the smoothness of working of the stoking-machine; and it struck him very forcibly that the days of the gas stoker were ended. He trusted that the machinery would go on working as sweetly as they

had just seen it doing, and that it would be the means of bringing increased prosperity to the Gas Company, to whom he asked the members to accord a hearty vote of thanks.

Mr. J. D. SMITH, in acknowledging the vote, said the Directors were always delighted when anyone asked to look over their gas-works. The Chairman and he had visited a good many works, with a view to getting information; and it was only by moving about that they found out what was the best suited for them. In Stirling they had very good carbonizing plant. The cost of working the machinery was 1s. per ton of coal, which they thought was a very good result in works like theirs, in which they carbonized 57 tons per 24 hours. The visitors saw the machine working with the Company's stokers. It had been in their own hands for fully two months; and he thought that since they had had charge of it they had been able to do quite as well as was done when the plant was in the Contractors' hands. The men, working the machines from day to day, took a pride in them. So far as could be seen, those on the discharging side had very much less work to do than formerly.

Mr. W. B. M'LUSKY (Perth) remarked that during the past ten years there had been a gradual closing of the breach between English and Scottish gas-works practice; and this had been exemplified that day. The coal Mr. Smith was using corresponded very closely with English coal, and his method of treating it was in every respect English practice. In all its details, it was satisfactory, so far as they could see. He thought Mr. Smith might rest satisfied that he had in his works the latest improvements in coal-projecting and coke-discharging plant. In his opinion the installation in Stirling would be the forerunner of many others in the country.

Mr. W. BLAIR (Helensburgh) reiterated what the previous speakers had said. He quite believed they had in Stirling the most up-to-date carbonizing plant in Scotland. Such works as they had seen could only set managers thinking as to how they were to get the same appliances themselves, because stoking was such a very hard task for men; but machinery made the work easier, and reduced the cost. It behoved them all to adopt something of the kind; and what they had seen at Stirling ought to encourage them to introduce machinery for the handling of coal and coke.

LARGE STEEL PIPE-LINE FOR ST. LOUIS.

Among the improvements in the water supply system of St. Louis (Mo.) that are under construction is a 7-feet steel pipe-line, 19,634 feet in length. The line extends from a series of settling-basins near a low-service pumping-station, at the Chain of Rocks, ten miles above the central portion of the city, to a high-service pumping-station at the northern end of the latter. Water is drawn from the Mississippi River by pumps in the low-service station, from which it passes through the settling-basins before being delivered to either of two high-service pumping-stations which supply the distributing mains directly. The following particulars are taken from "Engineering Record."

A horse-shoe-shaped brick and masonry conduit, 11 feet wide at the springing line of the arch and 9 feet high, extends from the settling-basins to the two high-service pumping-stations at Baden and at Bissell's Point; the former being about four miles and the latter seven miles down the river from the basins. Although this conduit has a sufficient carrying capacity to supply the two high-service stations, even during periods of maximum demand for water, it is at present the only means of conveying water to these stations; so the 7-feet pipe-line has been laid to the first high-service station to ensure a supply at all times. The new line starts at an outlet gate chamber near the down-stream end of the basins at the Chain of Rocks, and parallels the brick and masonry conduit at varying distances to a 25 million gallon storage reservoir at the Baden high-service station. The gate chamber from which the line starts has conduits connecting it with all the settling-basins, so that water may be drawn into it from any of the latter. The line is laid on a grade of about 6 inches to the mile from this chamber, which gives it an estimated carrying capacity of 35 million gallons per 24 hours without head. It can, however, be operated under a 15-feet head, and will then deliver 10 million gallons per 24 hours. It is nearly all in cut; only a few crossings of waterways being required.

A creek crossing about midway on the line requires the only bridge structure of any size. The bridge is 137 ft. 6 in. span, having two Warren trusses with riveted connections, which are 14 feet apart on centres; the height of the truss from centre to centre of the chords being 11 feet. The bridge has a light concrete roof and floor, both carried by transverse steel beams between the trusses. The floor system is designed to carry a live load of 50 lbs. per square foot, in addition to its own weight, the weight of the 7-feet pipe-line filled with water, and the concrete supports of the line. The roof is proportioned to carry a uniform live load of 100 lbs. per square foot in addition to its own weight. The wind pressure for which provision is made in the design is assumed to be acting horizontally in either direction at 30 lbs. per square foot of a surface bounded by the extreme dimensions of the bridge.

The line is made of soft open-hearth steel plates ½ inch thick and 84 inches wide; only one longitudinal joint being allowed to each plate. The tensile strength specified is between 52,000 lbs. and 60,000 lbs. per square inch; the elastic limit being required to reach at least 30,000 lbs. per square inch. The pipe is assembled with taper rings in 28-feet lengths, each made up of four rings. The small end of each ring at the transverse joint is inserted within the end of the next adjacent ring; the inside diameter of the small end of each ring being 84 inches, and the inside diameter of its large end adequate to allow the end to fit over the small end of the adjacent ring. The lengths of pipe were tested at the mill under a hydraulic pressure of 30 lbs. per square inch before being coated. After passing the test, the lengths of pipe were cleaned and heated, and then dipped in a bath of mineral rubber asphalt coating.

The construction of the line did not present any particular difficulties, as most of the excavation was in soil which stood well after the trench had been opened. The depth of cutting for about half the length of the line was less than 12 feet; and for the remainder it ran from 16 to 22 feet. In the more shallow excavation, the latter was made by hand; and in nearly all this part of the work no shoring was required.

A steam-shovel mounted on a travelling platform is being used in making the excavation for the deeper sections of the trench. This platform, which is about the size of that on which a regular 20-ton Vulcan steam-shovel is mounted, carries a boiler and a hoisting engine to operate the crane and dipper arm. The platform is carried by four 18-inch I-beams, 30 feet long, two of which are placed across the trench under the front end of it, and the other two under its rear end. These beams have truss-rods connecting their ends; the latter resting on rollers on plank runways laid on both sides of the trench. These runways are back 2 feet from the top of the trench, and distribute the load on the sides of the latter to such extent that in the soil thus far encountered no caving has been caused by the load of the shovel outfit. The latter removes the principal part of the excavation; the extra space required at the joints between the 28-feet lengths and the extra trimming being done by hand.

The city of St. Louis operates a standard-gauge electric railway between the low-service and the two high-service pumping-stations, which railway parallels the location of the 7-feet line at a distance of 50 to 300 feet. The railway connects with steam railroads in the city, and on it has been delivered upwards of 5300 tons of the steel pipe required in building the line. The pipe was brought in over this line in the cars on which it was loaded at the mills, and in a large portion of the trench was unloaded along the section it was to occupy; so that little difficulty was encountered in transportation.

The pipe is lowered into the trench by a stiff-leg derrick set between the latter and the electric railway. Each 28-feet section of pipe is lifted by one line round the centre; this line being threaded through a hose to prevent injury to the coating of the pipe. The joints between the 28-feet sections are made with pneumatic hammers supplied with an under pressure from either of two compressor outfits mounted on four-wheel trucks. One outfit has a 10 inch square Laidlaw-Dunn-Gordon compressor, and the other a 10 in. by 12 in. Curtis compressor, each of which is direct-connected to a 50-H.P. motor which receives power from the transmission line of the electric railway. They can be moved readily by one team. The pipe-line is tested, in lengths of approximately 2000 feet, to a hydraulic pressure of 30 lbs. per square inch. This pressure is maintained until all leaks in the entire section under pressure have been caulked and the pipe made tight.

The 25 million gallon storage reservoir to which the line delivers at the up-stream one of the two high-service pumping-stations has only recently been completed. It has buttressed reinforced concrete side walls, and its bottom is lined with concrete. The excavation for the basin was nearly all made in dense limestone rock; the tops of the sides of the basin being about flush with the ground surface. The line terminates in a gate-house at the reservoir. A connection is made between the house and the reservoir, and a 60-inch spigot-and-socket cast-iron pipe is extended across the latter on concrete pedestals, 10 feet high, to the pumping-station. The line is also connected through the gate-chamber to the brick and masonry conduit from the settling-basins at the low-service pumping-station.

Income-Tax Legislation.—We have received from Messrs. Butterworth and Co., of Bell Yard, Fleet Street, the sixth edition of "The Acts relating to the Income-Tax," by the late Stephen Dowell, M.A. It has been produced under the supervision of Mr. J. E. Piper, LL.B., of the Middle Temple, the Assistant-Solicitor of the Inland Revenue, who has revised and considerably enlarged the work, and brought the contents up to date. These now include the important provisions of the Finance Act, 1907, relating to "earned income," returns by employers, extensions of time for making assessments and recovering penalties, &c.

Sir George Livesey's Paper on Co-Partnership.—The paper on "Employers and Employed and Co-Partnership," read by Sir George Livesey at the last meeting of the Southern District Association of Gas Engineers and Managers, and published in the "JOURNAL" for the 19th ult. (p. 557), has been reprinted in pamphlet form, with some additions and the report of the discussion. The additions consist of suggestions for a printed statement explanatory of the system to be given to employees and a form of agreement. The paper is preceded by the editorial comments upon it which appeared in the same issue; and there is a short preface by the author.

UNDERGROUND WATER—THE RIGHT OF USER IN THE LIGHT OF RECENT ENACTMENTS.

By Alfred B. E. Blackburn, B.Sc., F.G.S.

[A Paper read before the Association of Water Engineers.]

The Existing Law.

The owner of land through or over which any surface stream or river flows has, according to the existing law, the right to take water therefrom for his reasonable use—that is to say, for any ordinary purposes connected with his land; but he may not interrupt or impede the flow of the stream or river. In a similar way with regard to water lying or flowing *under* any land, the owner has the same right of user if the water is flowing in a known or defined underground channel as if it were on the surface. But, should the underground water not be flowing in any known and defined channel, the owner may then make any use of the water he likes so long as it is under his land. He may not, however, so use or deal with it as to contaminate and spoil such water as will naturally flow or percolate under his neighbour's land.

Thus the law recognizes two different conditions with regard to underground water—

(*a*) Water flowing in a known and defined underground channel—in which case the owner of the land has the right to use the water for ordinary purposes connected with his land.

(*b*) Water not flowing in any known or defined underground channel—in which case there is practically no restriction on the landowner as to the use to which the water may be put.

It is convenient to consider three cases of land ownership with regard to the legal right of user of underground water—

(1) That of an ordinary landowner.
(2) That of a water authority.
(3) That of a railway company.

(1) An ordinary landowner seldom requires water for any purposes except those connected with his land and the buildings thereon, and probably in most cases the amount of water he obtains from his well does not prevent any adjacent landowner also obtaining sufficient water to meet his needs. Even if a large quantity of water were available by deepening his well, the owner is not likely on the score of expense to sink any deeper than is necessary to give him the supply he desires; and if he did obtain a larger quantity he would have to incur further expense in order to distribute and dispose of it. He cannot, moreover, take the water beyond the limits of his own estate without the sanction either of adjoining landowners or of the local authorities. The landowner who requires water for trade purposes—such, for example, as a brewery—is in rather a different position, as the quantity of water he abstracts may be so large as to deprive neighbouring owners of water. In both cases, however, the use of the water is limited to purposes connected with the enjoyment of the land.

(2) A water authority obtains water essentially for purposes of distribution, and is naturally desirous of obtaining the maximum amount of water to be obtained from under any given land. Its operations may therefore result in injury to adjoining landowners by drawing off the water under their land. The case is entirely different from that of the ordinary landowner, as the water authority has special facilities granted by Parliament for carrying out its works both in regard to the raising of the necessary capital, the power to break up roads and lay pipes for the distribution of the water, and also as to the revenue to be derived from the sale of the water.

An Act of Parliament giving a water authority power to sink wells does not, however, give a legal right to the underground water over any particular area such as is given in the case of overground water; and if a railway company or a large trading concern puts down a well in the vicinity of an existing well owned by a water authority, diminishing thereby its supply of water, the latter has no legal remedy.

(3) A railway company differs again from an ordinary landowner or trading concern by the fact that it has special facilities for distributing water by means of pipes laid along its railway lines. It is quite open, therefore, for any railway company to sink wells on land adjoining their lines, and, having obtained large quantities of water, to distribute it in this way. A railway company has no power to sell water; but these facilities for distribution enable it to make a very extensive use of any water for its stations, signal cabins, locomotive and carriage sheds, employees' dwellings, and hotels. In fact, this is done by many railway companies.

The author has in mind two cases where a railway company brought water some 8 or 10 miles, by means of pipes laid along the railway, in order to supply their locomotives and stations. In both cases the water was obtained from a statutory water authority in their district of supply, and taken into, carried across, and used in the district of another statutory water authority, thereby depriving the latter of considerable revenue. The railway company were apparently not doing anything illegal; but possibly the water authority into whose district of supply the water was brought could have applied for an injunction restraining the water authority supplying water from doing so for use outside their own area. Failing this, there is nothing to prevent any railway company whose line passes through the areas of several water authorities, taking into consideration the different qualities of the available water supplies and the prices at which they are offered, and taking a supply from whichever water authority it prefers.

Inequity of the Existing Law.

The consequences of the existing law in the way of injury to the adjacent landowners by depriving them of water, are sometimes contrary to the principles of equity. For example, water may be pumped from a well and conveyed a long distance for the benefit of people having no interest in the land on which the well is sunk, while the people living adjacent to the land may be altogether deprived of water. Yet, owing to the difficulty, or one might say, impossibility in most cases, of proving that there is a known and defined underground channel, there is nothing illegal in such a procedure. A system which permits of a large township or other authority obtaining the water rights of any district to the detriment of smaller bodies or persons who have a natural claim to a share of the water rights, and yet do not perhaps assert it either on account of want of funds or from apathy or ignorance, cannot be regarded as equitable. Again, Parliament having put the responsibility of providing a good and ample supply of water for the inhabitants of any district upon a water authority, and, having allowed it to spend large sums of money in constructing works and sinking wells for the purpose, it is not equitable that the authority should be liable to be deprived of its supply of water or to have it diminished by a neighbouring authority, a trading concern or a landowner sinking wells in close proximity.

Thus, under the existing law, it is possible that any landowner or water authority may be legally injured and yet have no remedy. Owing to this possibility of injustice being done, Parliamentary Committees have in several cases refused to sanction schemes for sinking wells.

The Protection of Water Supplies in Recent Enactments.

In recent years, there has undoubtedly been a tendency on the part of Parliamentary Committees in authorizing schemes involving the abstraction of large quantities of underground water, to give protection to persons having any interest in the use of such water, where it can be shown that any inequity is likely to be caused. This has been done either by granting compensation to the persons affected, or by limiting the operations of the body seeking powers to abstract the water.

By a recent Standing Order of the House of Commons the Referees on Private Bills may allow any petitioners to appear against a Bill, who allege that any water or water supply of which they may legally avail themselves will be diminished or injuriously affected by the provisions of the Bill.

Taking the three cases of landownership as before, we may notice the application of recent enactments to each case.

(1) *The Ordinary Landowner.*—In several Water Bills a provision has been inserted binding the promoters to give a supply of water to landowners and others should their operations prejudicially affect any existing wells or ponds, or in some cases as an alternative, to pay compensation in money. Similar protection is almost invariably given to owners when land is purchased by agreement by water authorities for constructing works.

(2) *A Water Authority.*—In many Bills during the past ten years Parliament has given protection to water authorities depending upon underground sources of supply by inserting a proviso that the promoters shall not sink any well within a certain distance of existing wells, or within certain specified areas.

During the past session (1907) an important and far-reaching clause has been inserted in several Water Bills, the effect of which is to deprive the water authorities concerned of the ordinary rights of landowners as regards underground water under land hereafter acquired by them, except such land as is specifically authorized by Parliament to be taken for the purpose of obtaining water.

All Private Water Acts invariably incorporate the Water-Works Clauses Act 1847, and also a special clause giving the water authority power to acquire additional lands by agreement for the purposes of their undertaking. Clause 12 of the 1847 Act gives power to sink wells or construct other works upon lands authorized to be taken by the water authority; and for many years past it has been the practice of water authorities in this country to avail themselves of these provisions by sinking wells and constructing "principal works" on land acquired by agreement. From the point of view of the water authorities, this method of procedure has undoubtedly been advantageous, in that it has not been necessary to expressly define each of the "principal works" in the Special Act, or to make such provision for further works as would otherwise have been necessary. The cost of land purchased under such clauses has, moreover, been much less than for land purchased compulsorily where the purpose for which the land is required is of course generally known, and, generally speaking, the cost of promoting schemes and carrying out works has been considerably lower than would have been the case had it been necessary to expressly define the whole of the intended works in the first instance.

It may, of course, be said that the object of a clause enabling lands to be purchased by agreement was never intended by Parliament to apply to "principal works," and was only intended to apply to work of a subsidiary nature. It has been urged, however, before a Joint Committee of the two Houses of Parliament that a roving power to take lands coupled with the powers conferred by section 12 of the Water-Works Clauses Act, 1847, would or might operate prejudicially to interests which had no opportunity of safeguarding themselves. Parliament has therefore inserted a clause in recent Water Bills to the effect that abstraction of water should not be sanctioned except from lands, and by means of works, expressly defined and authorized. The clause is in the following form:—

Limiting Powers of Company to Abstract Water.

"The Company [Board, Council] shall not sink any well upon or construct any works for taking or intercepting water from any lands acquired by them after the passing of this Act unless the works and the lands upon which the same are to be constructed are specified in this or some other Act of Parliament."

There is little doubt that a similar clause will be insisted on in future Water Bills, and that the clause be included in the Model Bill. This clause will certainly involve increased cost to water authorities promoting Bills and constructing works; and beyond this it will not be possible for them to purchase lands for certain defined works and afterwards carry out other works thereon.

(3) *A Railway Company.*—A very important clause affecting the right of user of underground water, and also the right of a railway company to convey water along their line from one district to another was sanctioned by Parliament in the Sutton District Water-Works Act, 1906. This clause is likely to be taken as a precedent, and I therefore give it in full:—

"From and after the passing of this Act it shall not be lawful for any company, body, or person, except with the express authority of Parliament hereafter obtained, to convey by pipe or conduit for sale or use beyond the area of supply water taken from any well or watercourse within such area.

Provided that nothing in this section contained shall take away:

(1) Any right of any landowner (other than a railway company) to supply with water any part of his estate situate within or partly within and partly without the area of supply, or to construct works for that purpose; or

(2) Any right of any railway company to supply with water any station or stations within the area of supply or to construct works for that purpose or to use on any engine or carriage without as well as within such area water supplied at any such station or stations."

Amendment of the Existing Law.

There is a general consensus of opinion that the principles governing rights to underground water should be equitable to all parties concerned. The protection given by Parliament in the cases mentioned is a clear admission that the existing law is at fault.

A leading Counsel some years ago said: "The law of underground water as it now stands is simply silly." It is felt that Parliament should reasonably safeguard all water supplies authorized by them, and at the same time make provision for protection (*a*) to those who already have a water supply which may be affected by the powers granted, and (*b*) to those who have a natural claim to water from the same source. Parliament has, in the recent enactments referred to, recognized this principle, but at present this protection is only available to those authorities or persons to whom the particular Private Acts apply. The question therefore arises, Is not an amendment of the general law desirable? Should not the Railways and Water-Works Clauses Acts be amended so as to embody this principle? This suggestion, however, at once raises the whole question of the allocation of underground water. The tendency in past times has been to treat the supplies of water of this country as if they were inexhaustible, and to allow an individual or a group of individuals in any given locality to utilize them without reference to the effect of such utilization on the community at large. There has been too little inquiry into the collective needs of the urban and rural inhabitants. It therefore seems to the author that the time has arrived when a comprehensive inquiry on scientific lines should be made into our underground water resources, with a view to the substitution of some more equitable system of allocation for the present improvident and haphazard method of dealing with the matter. The gradual depletion of the total volume of underground water by reason of the growth of our towns and cities, and of improved land drainage (which reduces the quantity of rainfall percolating into the water-bearing strata), should have most serious consideration.

The author maintains that until a complete scientific survey has been made and full statistics and information obtained as to the probable quantity of underground water in particular districts, including data as to its sources, levels, direction of flow, and other cognate matters, and until this information has been thoroughly analyzed by qualified experts, it would be unwise to make any radical alteration in the existing law affecting underground water; but in the meantime the principle of protecting public and private interests on lines already recognized by Parliament should certainly be made general in its application.

Allocation of Underground Water-Bearing Areas.

The allocation of underground water areas on a common-sense and scientific basis is a vital matter to the health and wealth of the nation. Who is to undertake the necessary preliminary investigation, the survey of our resources, and the compilation of the statistics, on which alone any satisfactory scheme for allocation can be based? Clearly, it can only be done by an authoritative body possessing certain compulsory powers. Much, it is true, can be accomplished in this direction by voluntary means—instance the compilation of rainfall returns; but no mere voluntary collection of facts would meet the case.

In 1903 an influential and representative deputation, on which the County Council Association and various Societies (including our own Association) were represented, waited upon the Local Government Board to call attention to the question of the protection of the water supplies of England and Wales, and to the pressing necessity for an enquiry into the existing state of the law on the subject. It advocated the establishment of a controlling authority or authorities (1) to prevent water being taken, without parliamentary sanction, for sale outside a given area, to the detriment of local interests; (2) to guard against the pollution of rivers and other sources of water supply.

It has also been suggested that the present functions of the Local Government Board should be subdivided between a Poor Law Board and a Public Health Board, with a Water Department attached to the latter body.

Mr. Forbes, in the current issue of the "Quarterly Review," states that if a central authority to deal with all questions relating to public health and water supply were formed, the staff, in addition to the administrative head, should consist of (1) an engineer and assistants, with special knowledge of geology and water supply, to be charged with the duty of collecting and digesting for use all the facts requisite for the scientific treatment of our sources of water supply; (2) a bacteriologist and a chemist, with special knowledge of the bacteriology and chemistry of sewage, trade effluents, and water supply, who should be provided with a laboratory for experiments; and (3) a staff of inspectors for carrying out the supervisory work of the authority with respect to both pollution and waste of water. The multiplication of Government Departments is probably not an unmixed blessing; but some such authority, guided by experts thoroughly competent to give unbiassed opinions, based upon a thorough understanding and appreciation of all the facts, would be of inestimable value in advising Parliamentary Committees with special reference to the conservation of underground and overground water in the best interests of the community.

The author is of opinion that local interests in the matter of water supply will always be best served by local bodies—either, as at present, by companies or councils, or by composite bodies representing all interests in the particular area concerned, and that the control of the central authority should be limited to the obtaining of returns, inspecting works, taking samples, &c., with the necessary power to enter upon private lands for these purposes. The essential function of any central controlling authority would be to obtain a thorough knowledge of all facts relating to the conservation and allocation of water areas and, having this knowledge, to see (1) that the welfare of the public at large is best served by any scheme put forward, and (2) that no injustice is done to interests that for various reasons may be unable to protect themselves.

Discussion.

The PRESIDENT said Mr. Blackburn's paper would form an important addition to the Transactions. For years past, the Association had had a Water Boards Committee, who had been watching the various points touched upon in the paper. If there was anything coming before the public which particularly affected the questions falling within the scope of that Committee, a meeting was held to discuss the matter. As Mr. Blackburn had said in his paper, they had already had one interview with the Local Government Board; and he (the President) trusted the Committee would in the near future be able to influence that body to look after the rights of the various water-works—whether company or local authority.

Mr. F. J. BANCROFT (Hull) said this was an extremely interesting paper; and although agreeing in many of the conclusions of the writer, in several places he appeared to regard as equitable the maintenance of existing conditions on land over water-bearing strata. Let them consider for a moment what these conditions were. In many instances, due to the position and character of the strata, underground water which fell many miles away as rain on other land was concentrated in a particular locality, and in some cases flowed at the ground level under slight pressure. Were the particular owners upon whose land this occurred to have the result of these conditions perpetuated and maintained for ever? To his (Mr. Bancroft's) mind, it seemed most equitable that other landowners and inhabitants less fortunately situated should be able, either individually or in combination, to purchase a plot in the favoured area, and to draw upon this underground supply. Consider what the result of this combination would be. The draught on the underground supply would probably lower the level of the water; and adjoining owners, if they wished to maintain their supply, must dip a little deeper than previously to get to the surface of the water. He failed to see the hardship. In all cases of combined effort and in large supplies, it would appear equitable for the adjoining owners who were injuriously affected to be able to demand a supply on conditions suitable to the case to be furnished to them at cost price, including a charge for interest on capital expenditure. They would then be able to share in the general supply, but not obstruct it by demanding their original and prehistoric conditions to be maintained intact for ever. For it must be remembered that a supply for (say) a large manufactory or for a general water supply invariably had the effect of raising the value of the neighbouring land; and the owners were quite willing to silently participate in the enhanced value while they vehemently protested against the so-called injurious alteration in their water conditions. Some such provision as he had mentioned would overcome most of the objections raised by Mr. Blackburn. In the case of a Railway Company, the matter was somewhat different; and he would like to draw the attention of the members to the recent case which had been fought out in the Courts, of the Attorney-General (at the instance of the Hull Corporation) *v.* North-Eastern Railway Company. The Railway Company were also the owners of extensive docks at Hull; and for some time had partially supplied themselves with water for railway purposes by a small installation of their own. The Hull Corporation, who were the water authority for the district, had supplied with water one of the principal docks—viz., the St. Andrew's Dock, upon which water was used for the general purposes of the dock, and also by private tenants of the Company, on land round the dock. The Railway Company had recently enlarged their water-works and pumping plant on railway land at Hessle, inside the Corporation water area, and about 5 miles from Hull; and, by laying mains alongside the railway, they had now taken over the supply to the St. Andrew's Dock, after giving notice to the Corporation to cease their supply. It was contended, on behalf of the Corporation, that if the Company had the power to construct works to supply the railway they had no power to supply the dock (because when the two undertakings were amalgamated there was a special clause put into the Act, saying the two should be kept distinct), and even if they could do this, it was *ultra vires* for them to supply the private tenants round the dock. It should be mentioned there was nothing in the Corporation Water Acts giving them a monopoly of the water supply within their district. The Corporation failed in the High Court, and also on appeal—the four Judges deciding against them. One of the Judges, in fact, remarked that it was not only legal for the Railway Company to do what they did, but it was their duty to make the most of the natural advantages of the underground water supply for the benefit of the shareholders. The author of the paper was therefore not correct in the light of the judgment in the Hull case in stating that a Railway Company had no power to sell water. He also appeared to be under the misapprehension that a water authority possessed a monopoly in the supply of water. This was incorrect, unless expressly stated in their Act. What the authority possessed was the power to break up the public streets for the purpose of main-laying and the power to recover water-rents; but this did not constitute a monopoly. A private individual could supply himself, his tenants, and his neighbours with water, so long as he did not have to open the public thoroughfares; and he might even do this with the permission of the road authority. But a railway was a creature of Parliament, and should not be considered to have the rights of a private landowner. Its powers were specified by Parliament; and it should not be allowed to construct water-works unless specially authorized. Surely now that water authorities were being restricted from constructing water-works for taking or intercepting water unless specially authorized by Parliament, railway companies should be brought under similar restrictions. Subject to these remarks, he agreed with Mr. Blackburn's opinion, that it would be unwise to make any radical alteration in the existing law affecting underground water. What was needed was the strengthening of the Local Government Board in this department of work; and in every Bill considered by a Parliamentary Committee, a water engineer should be present on behalf of the Board to advise the Committee. There would then be a probability of some uniformity of practice, and not as now Committees giving decisions depending principally upon the eloquence and pertinacity of contending Counsel, who advocated a principle one day, and opposed it the next. They had been promised by the President of the Local Government Board a Bill dealing with Public Health next year. He (Mr. Bancroft) sincerely hoped that matters affecting water supply would receive that consideration from him which the importance of the subject demanded, and that among the questions dealt with would be the important one of the right of user of underground water.

Mr. H. ASHTON HILL (South Staffordshire Water-Works Company) said he did not notice that Mr. Blackburn said in the paper that there was a monopoly in a water company. Perhaps he (Mr. Hill) had overlooked it. He thought it was well known to most water engineers that it was not so,

and that a water company was really in the position so clearly stated by Mr. Bancroft. He knew of a case in his own district where a colliery company had been supplying water for their own purposes, and for several houses and works in the neighbourhood, by a pipe crossing two public roads, and going under the River Stour. He looked into the matter some years ago, to see if there was any way of dealing with the situation; but his Company's Solicitors had advised them that the Colliery Company had a perfect right to do what they were doing, and were acting within the law. The author of the paper had pointed out clearly the different position in which water-supplying local authorities and water companies were. He did not say the question did not affect local authorities more than water companies, because the former had to go to Parliament and to the Local Government Board, who watched pretty closely what they were doing; whereas in the case of a company they obtained parliamentary powers and borrowed money for the general purposes of their undertaking, and assuming they had unexhausted powers for land, that was all they wanted. They had not necessarily to submit plans in such a case. But if they wanted half-a-million more or less of money they simply asked the public for it, and proceeded leisurely to buy land, and put up a pumping-station on it. He was doing this practically always. He generally had two or three pumping-stations in hand. One, for example, had just been finished; they were completing another; and they were just now buying land for a further one. As a contrast, a local authority, when about to build a pumping-station, had great difficulty. They began to discuss the question of going to Parliament for further powers; and when they first thought of this, they told the public about it. Then they went on thinking about it for a year or two; and by that time the public and the landowners knew all. Then, of course, when the authority went to Parliament the proceedings were very costly.

Mr. W. Matthews (Southampton) said that the members could hardly have listened to the remarks of Mr. Ashton Hill without being convinced that, at any rate for once in its career, Parliament was very wise in putting limiting powers upon a company abstracting water. Mr. Hill had told them what he had done in his own Company, and one could hardly know what serious effect that might have had upon somebody who had a distinct moral right to waters flowing underground. He (Mr. Matthews) was very glad that the principles enunciated in the paper had come from Mr. Blackburn, who was a Company man. He thought it reflected great credit on Mr. Blackburn, that he had adopted such exceedingly broad views with reference to the rights distinctly belonging to private owners and others who were outside the water-supplying authority. His own opinion was that a great deal of the mischief that had been done in the past had been due to a certain amount of what he might call a grasping policy, and to not recognizing that the public and landowners had distinct rights in the heritages they had bought in all good faith in the past, and for which they had paid large sums of money, by attempting to deprive them of that which was a distinct advantage to their property. He was in total agreement with Mr. Blackburn that the time had arrived when every endeavour should be made to deal equitably with those who were likely to be affected by the abstraction of water in bulk. He saw no reason why any community should dump a well down near a man's property, and deprive him of water without compensation. In connection with the Bills upon which he had been engaged, he had never hesitated to accept a clause for the protection of those whom he thought had a reasonable right to protection. It was lamentable to notice in some cases (Mr. Blackburn indirectly referred to it in his paper) the cost that was put upon certain small owners in defending themselves against some of the large water companies and authorities. It was perfectly impossible that they could afford to involve themselves in the expense that was necessary to fight such a question; but, unless they did so, their whole property might be absolutely ruined. Mr. Bancroft referred to the Sutton district case, and generally drew some analogy between that and the Hull case. The cases were not on all-fours.

Mr. Bancroft: I did not compare them.

Mr. Matthews said the Sutton case was a peculiar one. He was not engaged in it; but he heard the whole of the evidence. That was a case where the Company had been in possession beforehand; and though the Railway Company had no doubt the well and spring was part of their property, they had not been pumping from it to any large extent. And Parliament, in its wisdom, thought that a large community like Sutton, to whom the Sutton Company had been authorized by Parliament to be the water purveyors, ought very properly to be protected against a railway company not merely using the water for their immediate purposes in Sutton, but taking it away for their requirements on other parts of the line. The question of railway companies and their powers was a very difficult one. He had had to deal with the same question himself in Southampton. There the South-Western Railway Company took over the old Dock Company some few years ago. The Dock Company's Act enabled them to sink wells and provide their own water supply; but the question arose, when the Railway Company took over the property, whether that power was merged in, and became part of, the railway property, and entitled the Company to raise water upon their own land, and convey it by way of the railway to other parts of their property. This raised a big question; and his Committee came to the conclusion it was one that should not be fought. They did not follow the example of Hull, and go to the Court of Appeal, and perhaps would have had to go to the House of Lords. They came to the conclusion they would probably suffer a defeat; but it was a serious point.

Mr. H. Ashton Hill asked permission to strongly object to this question being made one of Company *v.* Corporation. He protested against the assumption that any company in this country would act in a worse manner than a corporation. All the point he had desired to make in his remarks was that, under the Acts of Parliament, the procedure was simplified in the case of companies. They, of course, did make compensation where they did injury as provided by law; and he supposed local authorities did the same. But Mr. Blackburn, in reading, added a clause to his paper which was not perhaps noted; and he thought it ought to be prominently brought out. It was to the effect that any additional obligations put upon water authorities ought to be met by an equivalent increase in their water charges. They knew of a case where £10,000 had to be paid for damage some two or three miles away from the well. If water authorities had to meet claims for £10,000 or other sums, in providing for the wants of communities, there should be some equivalent from the water consumers. Shareholders certainly were entitled to a certain dividend; and if a great expense like this was going to be put upon them in future, the power to earn the dividend would be greatly reduced.

Mr. Matthews remarked that he hoped Mr. Ashton Hill did not think he was a special pleader for local authorities. As a matter of fact, he acted for two corporations and four companies.

Mr. Easton Devonshire (London) said he had hoped that Mr. Vaux Graham would have been present at the meeting. He was at the morning sitting; but unfortunately time did not allow of this paper being reached before luncheon. Mr. Graham, as many of the members were aware, was really the author of the Sutton Water Bill of 1906; and it was through his care and watchfulness that the Water Company were able to prove that the Brighton Railway Company would be able by pumping—not from an old well, but from a new one—to reduce the level of the water in the water-bearing area in which the Sutton Water Company were concerned. As a Director of the Sutton Company, he (Mr. Devonshire) was particularly interested in the matter. In regard to what Mr. Matthews said as to the position of water companies, he (Mr. Devonshire) quite agreed with the view of a water company's position as taken in Mr. Blackburn's paper. It was just as important for a water company to protect the general interests in regard to the abstraction of water, as to look after the other special powers they might possess. He (Mr. Devonshire) was also a Director of the South Hants Water Company; and Mr. Matthews managed the affairs of the Southampton Corporation Water-Works. Mr. Matthews, in conversation, had told him that the Corporation had such broad powers in their Act that they could come alongside the South Hants Company, and put down a well. But Mr. Matthews also practically told him that personally he would never refuse or object to a clause giving compensation for any injury they might inflict. When it came to the point, he did not believe Mr. Matthews would be the offender; but he did not think the Corporation would refuse to make use of these powers. Here was an instance where a corporation and a company were in exactly the same box; they might mutually injure or protect each other. It was not therefore a question at all between companies and corporations. With reference to Sutton, he might say there were two Sutton cases in a

sense. One was as to the right of railway companies to take water away from a district where power had been given to an authority—be it company or local authority—to supply water. That case was known to all the members; and he need not go into the details of it. But there it was an exceedingly serious matter. The Railway Company claimed rights as landowner over a strip of land they occupied, and said as landowner they were entitled to take this water away, and use it for any purposes, because it could not be shown that the water followed a defined underground course. The direction of the underground flow was, he supposed, one of the most ridiculous questions that ever got discussed in Courts of Law. In these cases both sides were right. Any number of experts were called, and, on the one side, the experts said the water was coming from the west, and on the other from the east. The one side knew just as much about the matter as the other. (Laughter.) But this they did know, that wherever the water was pumped, it came towards that place. (Laughter.) That was the proof of the direction of underground flow. When the Committee (who seemed to be a commonsense lot of men) were informed of the fact that, when the Brighton Railway Company started pumping, the water in a certain spring fell to a certain level, they said: "You do not want any experts here. It is quite clear that, when you pump, you interfere with the supply, and that is not right." The Bill was carried through under the name of the Sutton Water Act, 1906; but practically it was of general application.

Mr. BANCROFT: Is it?

Mr. DEVONSHIRE said it was not, of course, legally so; but the terms of the clause were very general. Under our dreadful system of legislation, each water undertaking, under similar circumstances, would have to go and defend themselves, and spend thousands of pounds in so doing, because the Act was not called the General Water-Works Act of 1906. To show the hardship—the iniquity—of the present system, in 1907 another great and powerful body, the Metropolitan Water Board, desired to invade the Sutton district. In their General Powers Bill of 1907, they asked for powers practically to do what they chose on any land they cared to buy. They wanted power to buy land in the Sutton district with all the rights of a landowner. In 1906, the Sutton Company had to spend £3500 to get the Brighton Railway Company out of the way; and to defend themselves on one clause in 1907 against the Metropolitan Water Board, they had to spend another £400. The whole system was really an iniquity, because in one session they got Parliament to say definitely that it would be unfair to let anyone come into the district and abstract water from the area and carry it away, and nine months later the same thing had to be repeated at at a cost of £400. There were two sides to this question; and, as he had shown, the water companies' side of the question was not less important than that of local authorities. They must, however, try to get to some general agreement on this matter, which would be fair and equitable, and so eventually—although for the moment perhaps injuriously affecting or causing a hardship to individual concerns—would benefit them by the general application. The President had referred to the Association's Committee on Water Boards, and to the part they took in joining with others in a deputation to the Local Government Board. Where the use of this Water Boards Committee would come in was this: He thought an organization should now be started for the collection and collation of water statistics. There were individual water authorities who hesitated to publish or make known even to a central authority like the Council of the Association, statistics which were absolutely vital to the information that it was essential should be obtained. To put the matter more clearly, a water authority would not want anyone else to know they had measured the level of the wells all round their district. If the facts became known, it might be said, "You have drawn these wells down;" and the only reply that could be made would be, "We know we have, but we could not help it." But it was absolutely essential that such information should be available, in order to give a central authority work to start upon. He thought if the Water Boards Committee could start in a humble sort of way collating such information, it would be a great advantage. The corporations said it was not to their advantage that they should show they had lowered the water in their neighbours' wells; but if they were given to understand that the collation was being done through a Committee to whom the information could safely be given, a good work would have been begun. Otherwise, it would be a long time before any actual progress would be made towards legislative action for the protection and control of the water supply of the country.

Mr. W. WHITAKER, F.R.S. (Croydon) said he should like to say a little on the Sutton question. The facts seemed to him to be different from the case they had heard of from Mr. Bancroft. In the Sutton case, there was an existing Water Company; and the Railway Company put down a trial-well about half-a-mile from the Water Company's well. They had every right to do this. The Water Company did not say they should not do it, because they had every right to supply the station and the buildings in the area, and that would not have damaged the Water Company, though it might have had a little effect upon them. But when the Railway Company proposed to take far more water, and supply distant parts of their railway—miles away—it became a serious matter. The Water Company said: "This is not right; we are here to supply this district, and it is as much as we can do to get water within the district to supply it." The Water Company wanted all the water they could get; and they were backed up in the promotion of the 1906 Bill by every Council in their area. There were not many companies who could say that, in any Bill they introduced into Parliament, they were not more or less opposed by the local authorities in their area. It was absolutely proved that the pumping at the trial well did lower certain springs, about as far off as the water-works. If the springs were affected, so would the water-works well be. The proof was sufficient for the Committee. That was a different case from a railway company supplying along its own line in a given district. In anybody's area, a railway company had a perfect right to save the rates it would have to pay the local authorities for water. If the London and Brighton Railway Company sunk wells along its line, they could supply every thimbleful of water they required, and nobody could say them nay. But railway companies were not established for taking water in bulk from one district to another. If they had such power, the Brighton Company could take every drop of water from the Sutton district. Their line went through the district across the dip from end to end; and, therefore, if they could do as they liked, they could make wells, and drive galleries, so as to take nearly every drop of water from the district. This was not what railway companies were intended for; and they had in the Sutton case a decision of Parliament setting this matter right. He did not say the decision would be correct in a General Bill. That would depend on circumstances. He was not at all sure that each individual case should not be investigated on its own merits. In the case quoted by Mr. Bancroft, the Corporation failed, as he (Mr. Whitaker) thought it likely they would fail, because the Corporation did not show that their water supply was in any way interfered with. They only showed that their income was interfered with; and that was simply a matter of trade. In the Sutton case, on the other hand, it was shown that the Company's stock-in-trade would be taken from them, and that was an entirely different matter.

Mr. F. W. HODSON (Loughborough) remarked that he believed in the necessity for the collection of all sorts of facts with a view to the elucidation of the very difficult question of underground water supply. But it seemed to him Mr. Blackburn was to a great extent tilting against a windmill with respect to the inequality of the existing law. If they went broadly into the matter, they could find no better tribunal than Parliament and the Local Government Board in which every case was threshed out on its merits, and all the information bearing upon the neighbourhood was brought to bear on the question.

Mr. BLACKBURN, in replying to the discussion, said he would refer first to Mr. Hodson's remarks. He said something about him (Mr. Blackburn) tilting at a windmill in the paper; but he did not know to what Mr. Hodson referred.

Mr. BANCROFT: He meant "water-mill."

Mr. BLACKBURN said he thought Mr. Hodson had rather mistaken what was said in the paper. He did not suggest that the central authority should allocate the water supplies of this country. What he did suggest was that the functions of such a body should be to collect facts and statistics, and to act in an advisory capacity. He agreed that Parliamentary Committees were perhaps as satisfactory bodies as could be obtained, and it should be for them to come to any decision in the matters under consideration; but they should have behind them some definite facts obtained by a central authority—facts which could be relied upon as being correct. He agreed that the abstraction of water did very frequently

benefit many people. Take, for instance, a colliery. The owners were often pleased if they could induce a water authority to put a well down near their colliery, because it might save them the cost of considerable pumping. He quite agreed with Mr. Easton Devonshire that the present system of obtaining parliamentary powers was certainly one leaving much to be desired, involving, as it did, incurring so much expense in meeting what was often factious opposition, or perhaps opposition taken with the view of depreciating the value of the concern. He did not suggest, as Mr. Bancroft seemed to think, that a water company had a monopoly.

Mr. BANCROFT: You said they could apply for an injunction.

Mr. BLACKBURN: That was only in the case of a railway company bringing water from the area of one statutory authority into that of another.

Mr. BANCROFT: It implies a monopoly in the district if they can apply for an injunction to prevent anyone else coming in.

Mr. BLACKBURN: I certainly did not intend to infer that a water authority had a general monopoly, but only that a water authority had no right to supply water outside its statutory area of supply. If so, then, of course, a water authority had a monopoly as against a neighbouring water authority. It was not a question of preventing anyone, but of preventing a neighbouring water authority possessing powers only to supply water within a definite area coming in. Proceeding, he said he agreed with Mr. Bancroft that the Local Government Board needed strengthening in the Water Department. There was only one other matter to which he would refer. Probably most of the members would know that the Metropolitan Water Board, at their meeting the previous week, passed a resolution empowering them to take up this question of water-supply areas; and that they were going to approach the Local Government Board with a view to a proper allocation of the water supplies of the country. He believed it was suggested in the first place that they should, in addition to taking powers for further supplies from the Thames Valley, also take power to purchase a watershed area in Wales. But rather than do that, they had agreed to go to the Local Government Board, with a view to induce the Government to take some action, probably on the lines he had sketched out in his paper. He did not know whether the Metropolitan Water Board would have more influence than the deputation which previously waited upon the Local Government Board. If so, they might see some legislation in the immediate future. He thought the Association should be very much to the fore in any settlement that might be made, or in any alteration of existing conditions, seeing that they represented the authorities who were chiefly concerned in this matter. In conclusion, he thanked the members very heartily for the manner in which they had received his paper.

Mr. PERCY GRIFFITH read the resolution passed by the Metropolitan Water Board on Dec. 6, as follows:—

> **That as the increase in population will eventually render resort to some other source than the Thames watershed imperative, the Board view with great alarm the increasing tendency of authorities throughout the kingdom to appropriate water-supplying areas for their own particular use, and, in these circumstances, desire to urge upon Parliament the necessity for regulating the appropriation of water-supplying areas, so that the needs of the Metropolis as well as of other populous places may receive due consideration.**

Mr. MATTHEWS asked whether the Council of the Association had the subject referred to in the resolution under consideration.

The PRESIDENT: We have, Sir.

Pressure in Hydraulic Mains.—The following method of determining the lowest permissible pressure in the hydraulic main was submitted to the members of the American Gas Institute at their last meeting: Starting at the pressures being carried on the main, make a number of tests of the gas for carbonic acid and oxygen. Then reduce the pressure 1-10th for several hours and repeat the tests. This should be continued until the tests begin to show some increase in carbonic acid and oxygen. Then, if the hydraulic main is in sections, tests should be made to determine whether the seals are being drawn on any special section, and, if possible, the leak traced to a certain stand-pipe, which, if defective, should be repaired. After getting the house in as good uniform condition as possible, the seal should be increased ¼ inch to ½ inch above the point where the leakage shows, and be maintained at that point; and the vacuum drawn by the exhausters should be readjusted whenever working conditions are changed.

REINFORCED CONCRETE IN GAS-WORKS.

[Abstract of Paper read, Dec. 14, before the Manchester and District Junior Gas Association, by Mr. Harold Davies, Assistant Gas Engineer to the Blackburn Corporation.]

After inspecting the gas-works at Blackburn, as you have done, I think the few notes I desire to put before you, will not be out of place. The construction of reinforced concrete is the development of the idea of Joseph Monier, a French gardener, whose work soon attracted attention in Germany and Austria, as well as in France; and reinforced concrete rapidly became a serious rival to brick and stone—one very striking feature of its development being the number of proprietary systems which have found support.

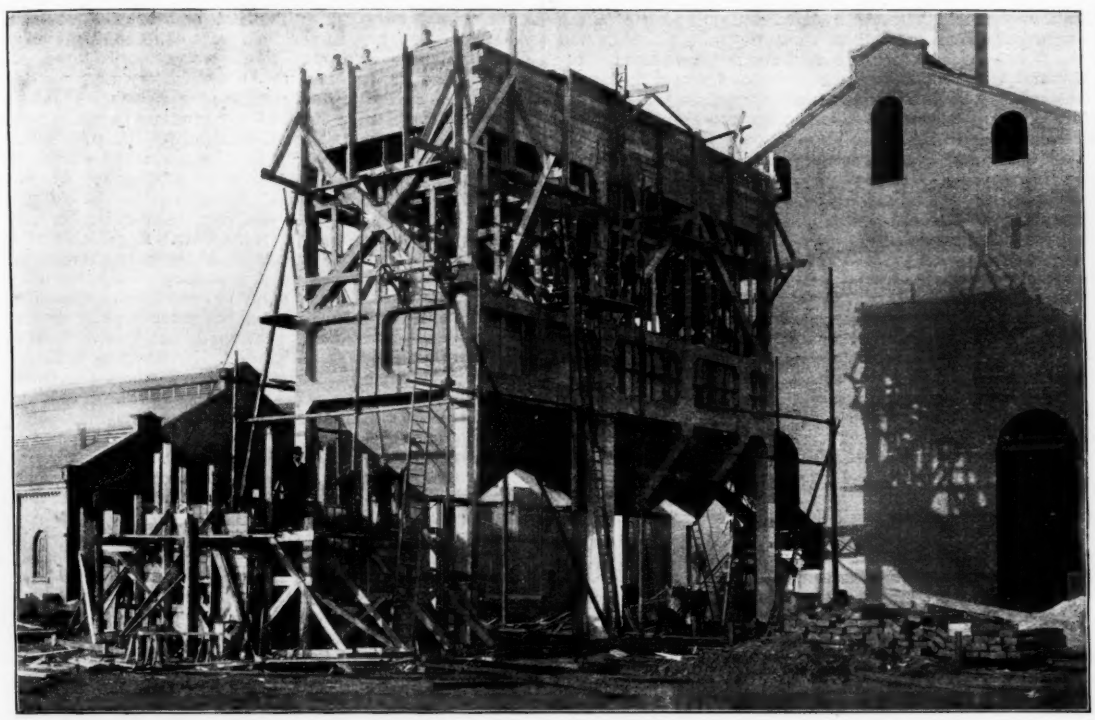
Perhaps it will simplify matters if, at the outset, I give you some details of the general points in the construction of the materials used, before proceeding to details of the structures for which it has been adopted at Blackburn. In designing structures of this material, it must be observed that concrete is usually about ten times stronger in compression than in tension, and that all designs should consequently be compressive wherever possible; all tensile strains being carefully committed to the steel.

Ferro-concrete is extremely economical where an imposing structure is not essential; the economy being due to the fact that so little skilled labour is required, except good supervision. The iron or steel bars can be delivered of the necessary lengths, and cut and bent on the site as required. The building can be done by ordinary labourers, so long as the concrete materials are properly proportioned and mixed, and well consolidated around the steel work. The steel is practically permanent under almost every condition; and the expansion and contraction of the steel and concrete are practically the same. Self-faced concrete in any exposed structure is not imposing or beautiful; but a good and even face of concrete is much cheaper and just as serviceable as masonry or brickwork. In such positions, however, if the casings or drums are well made, and kept coated with soft soap, and the concrete mixed rather wet and well rammed behind casings, a fairly good and even face is obtained; and an even better one is made if a sheeting of metal or oiled sheet on the inside is employed. Rendering of the face of the concrete should be avoided if possible, as it frequently flakes off and leaves an unsightly appearance. Ferro-concrete should not be used where the face is liable to be exposed to much variation of temperature, owing to the liability of cracking due to frequent expansion and contraction of the outer surface.

The foundations for the recently constructed retort-bench at the Greenbank Gas-Works at Blackburn are in ferro-concrete; the system adopted being the Hennebique, which is one of the simplest for this class of work. In taking borings and tests for the site of the retort-bench, it was found that for about 55 feet almost in the centre of the bench the ground was most unsatisfactory for procuring a solid foundation. For a depth of 12 feet from the ground level, it consisted solely of ashes and tipped refuse, below which was a bed of soft, spongy clay; and it was of too unreliable a nature to trust even the undisturbed surface of the clay with such weighty and important plant as the bed of inclined retorts, with all the accompanying floors, buckstays, hoppers, conveyors, &c., of which practically the whole of the weight depended for its stability upon the foundations. The site was also found to be quite water-logged at a depth of less than 5 feet from the surface; and this finally decided us in choosing the method of construction—monolithic slabs, supported by means of girders, they being in turn carried upon piles, all in reinforced concrete. The slabs carried all the superimposed weight; and I have no reason to doubt its permanency.

The piles are of reinforced concrete; and none will dispute their superiority over wood. The concrete consisted of two parts ¼-inch limestone chippings, one part clean pit sand, and one part portland cement, well mixed and consolidated carefully round the steel reinforcing material, which consisted of a rod of 1⅛-inch round mild steel in each corner about 2 inches from the surface of the concrete. The rods are bent inwards at the bottom and embedded in the pile shoe (which is of ordinary construction), and are held in position by wire distance-pieces about ¼ inch in diameter, bent to fit loosely round the 1⅛-inch rods, and keep them just the desired distance apart. These distance-pieces are placed 4 to 6 inches apart throughout the length of the pile. The piles are moulded in timber racks, and can be driven with perfect safety three weeks after moulding in the summer months. The piles can be made to any length, and can be lengthened after driving by moulding a continuation of the structure in position. At Blackburn the piles consisted of nine 40 feet long, three 25 feet long, and nine 15 feet long, all driven to a permanent set.

The piles being driven, the next operation is the construction of the beams, which are positioned much as is an ordinary floor. These beams or girders are constructed of the same materials as the piles; but the strain being altogether different, it is necessary that the steel work should be carefully placed. In the beams from pile to pile are set three series of rods. The rods of the middle set are bent in the form of a truss, having the central horizontal portion and each inclined portion of the same length horizontally—each being not quite one-third of the span, and the top bend being made a short distance from the supports. The other rods of the series are placed along the top and bottom of



Coke Storage and Loading Hoppers, with Water-Tank Overhead—Constructed of Reinforced Concrete—at the Blackburn Corporation Gas-Works.

the beam, with about 1 inch covering of concrete. The top bars are compression bars, while the bottom ones take the tensional stress. The straight bottom bars are supported by stirrups made of hoop iron; and these are spaced farther apart as the centre of the beam is approached. The depth of the beams is usually one-twelfth to one-fifteenth of the span, but can be constructed to suit circumstances.

The monolithic slab was formed of concrete and built at the same time as the girders were being laid, so that the whole might homogeneously set together. The reinforcing bars for the slab are three rods of ¼-inch steel crossed at right angles in the concrete; the bars being supported by hoop-iron stirrups. The rods of the piles are continued up into the beams; the tops of the stirrups in the beams terminating just below the surface of the slab, and the pile-rods being also taken into the slab.

Some slight idea as to the strength of floors so constructed as compared with floors of a type frequently met with in gas-works construction may be of interest. Take a floor consisting of main beams 12 in. by 8 in. and secondary beams 8 in. by 6 in., with a span of 16 feet and 7 ft. 5 in. respectively—all of reinforced concrete, carrying a reinforced concrete slab 3½ inches in thickness; the entire floor weighing 61 lbs. per square foot. This being subjected to a dead-load of 430 lbs. per square foot, showed very little deflection; and when subjected to a falling load of 2860 foot-pounds, it suffered practically no deflection, and the duration of vibration was very little over half-a-second. A floor of 10 in. by 6 in. rolled steel joists fixed 2 ft. 3 in. apart, having a span of 15 feet, and being filled in with arches and ordinary concrete, suffered double the deflection when subjected to only 715 foot-pounds; and the duration of the vibration on the floor was two seconds.

The cost of construction in the case of our retort-bench foundations was: Piles, 12 inches square, 8s. 6d. per lineal foot driven; other sizes in proportion. Beams, 5s. 6d. per cubic foot, and the slab 12s. per square yard 6 inches thick, and 15s. 6d. per square yard 8 inches thick; all guaranteed to carry a load of 5 tons per square foot. A fair average cost for reinforced concrete construction on the Hennebique system is: Roofs 1s. 6d. and floors (including beams) 2s. 3d. per square foot. Internal columns 9s., external columns 6s., driven piles 10 in. by 10 in. 6s. 6d., driven piles 12 in. by 12 in. 8s. 6d., driven piles 14 in. by 14 in. 10s. 9d., and driven piles 16 in. by 16 in. 13s. 6d. per lineal foot.

Another system of reinforcing concrete was adopted in the preparation of foundations for a set of annular condensers, consisting of sixteen tubes, 32 ft. 6 in. high, with seal pots, valves, &c.; the whole weighing about 160 tons, inclusive of supporting walls and base-stones. The ground upon which the weight was to be carried was of a very soft nature, but sufficiently stable for the purpose, provided the load was evenly distributed; and in order to ensure this, a raft was constructed of concrete and expanded metal. The size of this raft is 29 ft. 6 in. by 25 ft. 6 in. and 9 inches in thickness.

The metal used was of 3-inch mesh, and the strands ¼ inch by $\frac{1}{16}$ inch; and it was placed in two layers, each completely covering the site. A 3-inch layer of concrete was first prepared and covered with a layer of the expanded metal, the joints of which overlapped in every case 6 inches. This was covered with 4 inches of concrete, and another layer of the expanded metal laid as before; this being finally covered with a 2-inch covering of concrete. The concrete consisted of three parts broken fire-brick material (about ¾-inch gauge, prepared by passing old retort material through a stone-breaker), one part clean sharp sand, and one part portland cement.

The metal cost £15 for the two layers, or about 1s. 6d. per square yard superficial; the total cost being slightly under £30, putting the concrete at 15s. per cubic yard. The cost of 2 feet thick of ordinary concrete over the same site, at 12s. per cubic yard, would have been £33, and the strength not more than one-third that of the reinforced raft of only 9 inches thickness.

Perhaps, however, the most interesting part of the work erected in reinforced concrete at Blackburn is the coke storage and loading hoppers, with the water-tank overhead. Some very noteworthy features may be observed in this structure, particularly the hanging beams, which are probably unique for this class of work in England, and clearly show the adaptability of the material. The work was executed by the New Expanded Metal Company, Limited.

The reinforcing of the columns is carried out in round bars with hoop-iron distance-pieces, much after the manner of the piles already described. These columns are supported off, and jointed to, slabs or bases of ferro-concrete of sufficient area to bear the weight superimposed upon each column; and, of course, the area will vary according to the nature of the ground upon which the erection is being carried. In this case, we had good, solid clay. The whole structure is supported off six of these columns; the structure itself weighing approximately 280 tons, the hoppers when full carrying 90 tons of coke, and the water-tank holding 100 tons of water. In addition to this, the coke-conveyor, &c., have to be supported; and the shafting for driving the conveyor depends for its rigidity upon the stability of the structure. The water-tank is lined with asphalte; but I do not think this is absolutely necessary, as water-tight concrete should in every case be the ideal for important structures erected in combination with steel reinforcing. I feel sure that with extra care in the construction of the forms or moulds, and the proper consolidation of the concrete, which might with advantage in these cases be made fairly moist (perhaps liquid, so long as the moulds or shutterings are made water-tight), around the steel reinforcement, a tank perfectly water-tight would be constructed.

In the rearing of such a structure, much inventive carpentry is required to plan and construct the forms or moulds into which the semi-liquid concrete is poured, and rammed all around the steel skeletons. The footings, columns, walls, girders, beams, struts, floors, roofs, &c., all require separate forms intelligently devised with a view to economy and their easy and safe subsequent removal when the concrete is set. White pine is preferable for this, as it is readily worked and keeps its shape better on exposure; but spruce or fir may be used with advantage, if a rough finish suffices. Green lumber is preferable to dry, as being less affected by the water in the concrete.

The reinforcing of the struts is carried out similarly to that in the columns, except that the steel work is of much lighter nature, and the beams, which are of great importance, here contain a

combination of round bars, with extra strengthening of Kahn patent reinforcing bars, which give them the fullest rigidity and strength. The hopper bottoms are reinforced with one layer of expanded metal, with the assistance of a series of round bars, very ingeniously placed, having their ends extending through the bottom of the hopper, and to which the frames for the emptying doors are secured. The sides of the hoppers, and the whole of the water-tank sides and bottom, are reinforced with one layer of expanded metal.

The concrete was composed of Shap granite chippings, and the finer screenings from these, which is what might be termed the "dust" from the screens of the quarries, and is of a rough nature, and took the place of sand, which was not thought sufficiently reliable, uniform, or clean for the work—at least, the local sand was not. The cement was of the best quality; and the concrete when mixed consisted of two parts granite chippings, one part granite sand, and one part cement. Great care was taken in the mixing; and I do not think the foreman in charge of the work allowed a single bucketful of concrete to be mixed and put in the moulds without his actually seeing it done.

The cost of this work complete was £830; and I think it will be agreed that the material used for its construction has many advantages over the more common type of steel and ironwork erections, which are very costly in wear and tear and upkeep.

The use of reinforced concrete has been subjected to criticism in some quarters; but personally I think the criticism somewhat biassed. I am quite aware that failures are reported in this material; but I do not know of any serious failure in this country. This, I think, may be attributed to the British type of workmanship—"thorough." The greatest care in supervision, coupled with full time for the proper setting of the concrete, will ensure a well-designed structure being erected of reinforced concrete without fear of collapse, as its strength increases with age, and it is unaffected by atmospheric influences, and is absolutely fire-proof. The Local Government Board are stated to be very chary in granting loans for long periods for reinforced concrete structures. I cannot, however, see any justification for this. The cost of the structures erected at Blackburn will be paid from revenue account, so that I am not able to inform you what the Board's action would have been in our case. All extensions at Blackburn are carried out from funds provided by the surplus revenue account, in order that our already heavy capital expenditure may not be still further inflated. I think there is almost an unlimited field of usefulness for reinforced concrete; and probably in the near future we shall have all our buildings, floors, tanks, purifiers, and such plant composed principally of concrete reinforced with steel, at a very greatly reduced cost for construction.

Discussion.

The PRESIDENT (Mr. E. J. Wellens) said the subject was a new one—at least, it was new to him, and no doubt to others present. Mr. Davies would be pleased to answer any questions that might be put to him.

Mr. F. G. SHAW (Darwen) asked if it was necessary to have the rust removed from the metal before being put into the concrete. Was there not danger of moisture getting through to the iron after the concrete had set, and causing a collapse or decrease of stability?

Mr. DAVIES replied, as to the ironwork suffering from rust, that he could not speak from practical experience; but in structures which had been erected elsewhere they had stood for fifteen years, and had not shown the slightest deterioration. In fact, some iron, after long use, had been brought out in a better condition than when it was put in. Some steel, after being in the ground ten years, had come out perfectly bright. It was essential that the concrete should be absolutely water-tight. It was also necessary that the workmanship should be thorough; and he considered that English work was of this character, and second to none. This was the whole secret of success. He thought if water did get in not much harm would be done, because with water present there would be no room for air; and there could be no rusting without oxygen.

Mr. TAGG (Preston) said he should like to see how reinforced concrete stood the test of wear and tear for a time before he ventured to express any opinion upon it. There was not sufficient evidence forthcoming at present, so far as the English working of the material was concerned, to enable them to arrive at a definite conclusion. They must see some marked economy in it before they could recommend it. He could remember some concrete wall work which developed cracks. He wished to know the size of the granite chippings—the size of the mesh. No doubt the equality of expansion and contraction in the metal and concrete was advantageous. He did not consider, however, that the vertical rod in the columns was of much assistance. Where did the additional strength come from? The period allowed for the setting of the piles seemed to him to be very short; it must be some time before the water was expelled. At Liverpool they had been very careful in the use of the water. On the whole, he did not think the new method would prove a substitute for good iron and brick work. Still, the evidence to be forthcoming would be of the greatest value. It was good pioneer work; and Mr. Davies deserved the thanks of the members for his paper.

Mr. DAVIES replied that the method was not new, as it was introduced into France in 1864. It had been known and used in America for more than twenty years. Their work here was infinitesimal compared with what had been done across the Atlantic. So far as Englishmen were concerned, they were very Conservative. He advised those present not to jump at conclusions. Englishmen liked to see others try new methods and inventions before experimenting themselves. If all nations followed this plan, how could any progress be made? He considered the time stated for the setting of the piles was ample. Great care had been exercised in the amount of water employed. The concrete was not used in a very liquid state—only just sufficient to run round the rods. The screen for the chippings was of 1-inch mesh. The sand was very rough—rougher than could be obtained from any of our sea coasts. A month was allowed before the whole of the casings round the concrete were removed. They had not as yet seen any cracks. With regard to the hoppers and water-tank, neither had been filled. The tank would be filled to the extent of 1 foot of water for the first month, 2 feet for the second, and 3 feet for the third. At present the water was only accumulating from the rainfall. No pumping had been done. There was plenty of water in the soil on which the works were built. There were no stays to the structure. Some engineers had said they should not like to be near it when filled with water; but he was not afraid.

Mr. HEALD asked if they had yet had a fire in the hopper, and whether the concrete would slip. The co-equal expansion and contraction of the metal and concrete would, no doubt, be an advantage.

Mr. DAVIES replied that they had had coke on fire in the hopper—four tons on the first day. They had to drop a lot of it and quench it with water; but the concrete was thoroughly waterproof. Reinforced concrete was also absolutely fireproof. There need be no fear. In the new conveyor experiments, they threw water on the coke; but he was of opinion that it should be slaked directly it came out of the retorts. The conveyor they had seen that day would be new to them. They had a slaking arrangement at the top.

Mr. SHAW incidentally observed that the best arrangement he had seen for slaking coke was at Salford, where a series of water-jets, at what he should imagine would be about a pressure of 100 lbs. to the square inch, were arranged all along the sides of the conveyor.

On the motion of Mr. TAGG, seconded by Mr. OLDFIELD (Darwen), votes of thanks were passed to Mr. Ogden for allowing the Greenbank works to be open to the inspection of members, and to Mr. Davies for his paper.

Mr. DAVIES, in acknowledging the double compliment, said the preparation of the paper had given him the greatest pleasure; and if it had provided the members with some thoughts for study, this was all he had hoped to do.

A discussion, in which most of the members joined, afterwards took place on the operation of the settings at the Greenbank Works.

How Electric Light Competes with Gas.—The manner in which some municipal undertakings are conducted is shown by the disclosures at Nuneaton of the preferential prices given by the Committee of the Electricity Department to induce what they would doubtless call "business." It appears that some consumers pay 1d. and some pay 5d. per unit for light; and there are all kinds of intermediate charges. The penny is generally offered to tempt gas consumers to become users of electricity. The undertaking, however, charges itself 4½d. per unit, so as to swell the income and the profit and please the ratepayers, until they find out how it is done. There is likely to be some commotion among the users of current now that these facts have leaked out; and we understand that this municipal authority is likely to be called upon for damages in connection with the matter. It is rumoured that one idea of the Corporation is to compete in this unfair manner against the Gas Company, with the view of reducing the value of their undertaking for purchase.

Leakage in the Recuperator Flues of Retort-Settings.—One of the "Wrinkles" submitted at the last meeting of the American Gas Institute was on this subject. It was as follows: "The low temperature of gases leaving the stack of a gas-bench can only be explained by leakage of air from the secondary flue to the waste-gas flue. This leakage is a foe to good heats and economy. Suppose leakage does occur, the flow will be from the point of greater pressure to that of lesser pressure; and as exhaust flues must have the lesser pressure, the secondary air will flow to the exhaust flues. This has a deterring effect in two ways: First, some of the heat absorbed in the secondary flues is lost because some of the secondary air is lost; and, secondly, this air dilutes and lessens the temperature in the exhaust flue, and the differential temperature between the secondary flue and the exhaust flue is thereby lessened, and heat is transferred to the secondary air met further down. To lessen this leakage, use the stack damper to yield the least possible difference between the secondary and the exhaust flue. To determine the extent and approximate location of this leakage, make a flue gas analysis at the point where these gases enter the recuperator flues, and test at each flue going down. The increase of $O + O \times 3{\cdot}34\ N$ = leakage; and the increase of oxygen represents the leakage at each flue. A heat-balance can be worked out from this, and the loss due to leaky flues approximated. Sometimes leaks in flues can be plastered up, resulting in better heats and less fuel consumption."

GAS IN THE COTTON COUNTRY.

By Archibald S. B. Little.

In a recent article, I gave particulars of conditions obtaining in the gas business out in the Central West; and now, after a three weeks' visit to Oklahoma Territory, I feel impelled to acquaint English gas engineers with the state of the industry in that most wonderful land of progress. For Aladdin-like work, one needs to see a city spring up in the great South-West. Take, for instance, Oklahoma City. The first sod was cut there less than eighteen years ago; and yet to-day we find it a prosperous city with four and five storey buildings of brick and stone, having over 40 miles of paved streets, parks, and entertainment grounds, street railways, and gas and electric light. The gas-works have four beds of sixes, and also at a separate works attached to the electric generating station there is a Lowe double superheater water-gas set. It is not of this city that I would write, but of one about 100 miles south-west of it, which for obvious reasons I will not name.

The writer was asked to examine the works of a large company, and, from one of the five which have been shut down by the introduction of natural gas, was to select some machinery to transfer to the aforesaid town. Here also natural gas will be used; but owing to strikes among the Dagos who are laying the pipe-line, instead of having the work finished by last July it is likely to run to next May before the connection will be complete. This natural gas, I may say, will be pumped about 200 miles through 14, 12, and 8 inch steel mains at 250 lbs. pressure, supplying several large towns on the way; and at the commencement of the distributing area, it will be reduced to 5 lbs. pressure, after which separate governors will be used on each service. The price of the gas will be 35 c. per 1000 cubic feet; and this allows 8 c. profit for distribution. The artificial gas now is charged at $1, but does not earn great profits, for reasons which can be seen after reading the following report.

The plant before the alterations consisted of two beds of half-depth regenerative sixes, retorts 16 in. by 28 in. by 9 ft. 6 in. The exhauster was a Roots No. 1, and had to run at about 130 revolutions per minute to handle the gas. The balance of the machinery included a square tar-extractor, a 4 feet diameter tubular condenser, a 4 feet diameter washer, two steel purifiers 6 feet square by 4 feet deep, a 4 feet diameter meter, and a holder with steel tank capable of storing 60,000 cubic feet. The writer was not given an open hand about the new plant, but had to keep the cost below $3000. Some notes on how the plant was working during the carrying out of the alterations will give an idea of the way they try to make gas in quite a large number of American works, and it will likewise show how the cost of artificial gas is kept up and yet does not earn large profits. The company own and work the electric light plant as well as the gas; and the general manager admits he has no experience with the gas plant. There is a superintendent also; but whether he has charge of gas or electric plant, or of both, was a point I could not determine. There is no such thing as a foreman of the gas plant; and, to tell the truth, not one person in this town of 16,000 people has a correct idea, such as you have in English towns, of how gas ought to be made.

To commence with the retort-house plant. The two benches of retorts have both been in use for about two years, and they certainly carry high heats. All the retorts were very much cracked and distorted; and in some cases large holes could be seen in them. Notwithstanding this, the exhauster was run at high speed, and very often the gauge showed 3 inches of pull on the retorts! Exactly what was taking place could not be very well seen, because a trap was found in the pipe from the main to the pressure-gauge. When first inspected, the gauge was found broken away from the main; but nobody on the works seemed to know about it. There are three men to run the plant—one being the stoker, one a sturdy helper, and the third a lad for hauling away the coke. The stoker is responsible for the work, and has to look after all the machinery, including the gas-compressor for the high-pressure mains. This man is paid $65 a month, which is really a low figure for 12-hour work in the States, as most stokers get $70 to $75. The helpers are paid $45 a month; while casual help demands 20 c. per hour.

When I reached the works, I found the holder grounded, for the sixth time in two weeks. Next day, however, the supply was turned on, and the astonishing value of 6-candle power gas was reached. This was considered quite good, too, because, so far as my knowledge goes, there are only about ten incandescent lights in use in the town, and not a single flat-flame burner. All the gas is used for cooking; so the curious sight is witnessed of about 30,000 cubic feet going out of the gasholder between noon and 1.30 p.m., and again between 4 and 6 p.m. Between the last-named time and 6 a.m., the holder is pumped up 21 feet; but by noon it shows less than one plate. Before the alterations were carried out, the make was about 4000 cubic feet per hour; and the best power found during the first three days of my visit was 8 candles. However, if this could be guaranteed, there was no kick coming from consumers, as it was a perfect treat to be able to cook with gas when the shade temperature varied at mid-day between 100° and 102° Fahr.

I tested the seals on the two hydraulics, after being told they were respectively 1 inch and 1½ inches. On one I found no seal at all when the indicator stood at 1 inch; and on the other there was ½ inch, which, by reason of the arrangement of pipes, could not be readily altered. This, with 1½ to 3 inches pull on the exhauster easily accounted for the 6-candle power gas, and somewhat explained the consumption of over 50 per cent. of the coke in the producers, which were working with the primary-air flues choked. This latter trouble was easily overcome by leaving the clinkering door wide open! There were no drip plates in the furnace; and the back bearer bar had been burnt out. As in nearly every American gas-works, cold coke is fired to the furnace, and only once a week or so do the stokers fork it.

I was working partly through the night shift, and noticed that the night stoker did not charge certain retorts, giving as a reason that the superintendent had plugged up the dip-pipes with sacks, to prevent the sucking in of furnace gas. The day man knew nothing about this, and had been charging the plugged retorts right along. The charges are about 330 lbs. of coal every four hours. To show how the men work, I may say the boy hauled all the coke a distance of 60 yards, while the helper pulled about twenty charges. This left the stoker twenty charges to pull and forty charges to put in every twelve hours. He also had to oil all the machinery, start and stop the compressor, make out the daily report, and answer the telephone. Complaints about pressure and candle power are made to him; and it is on record that in one day he had something like 2000 calls on the telephone—all complaints.

One thing that is noticeable in nearly all American gas-works, is the working of four-hour charges, no matter what kind of coal is used. This means high heats; and thus retorts last on an average 18 months. But in cases where ordinary care is taken in firing the furnace, the term of useful work is about 28 months. However, it is a most unusual thing to find gas-benches treated with ordinary care, which is perhaps accounted for by the constant changing of retort-house men. There are not many men regularly employed on gas plants who really know what gaseous firing is. It seems to me that these men are familiar with furnace firing, because in nearly all cases they use one in their homes for heating purposes; and they then see how a clean fire can be let down, and be brought back to great heat quickly, by giving it a big pull on the chimney and plenty of air through the fuel. This principle they carry with them to the gas-works on regenerative benches. There are no men steadily engaged in retort-house work; and if there is a foreman who knows how the work should be done, he has so many things to look after that he has little time to attend to the benches. Now, Americans, especially casual men, are very independent, and will try their hand at anything sooner than sit tight and wait for instructions. This is a necessary condition where a man is expected to try and do anything that crops up, and is not blamed greatly if he makes a mistake. He is not looked down on provided he tries to do his best; and it is quite the exception for an American worker to break down on a job. My experience is that, where you have English speaking people in the United States, you have no such thing as what you call the "labouring class." Every man who works with his hands likewise uses his head; and even where he does rough work, he does it intelligently.

These remarks will make known to English engineers what the conditions are in building or working a gas-works in America. In building, the characteristics indicated are acceptable; but in working they are not entirely so—especially in retort-house operations (say) on the benches, where a false step will lead to irreparable damage. Such procedure will, in a way, account for some of the failures on benches out here, such as the cracking of retorts almost as soon as put in, and their complete collapse in three months. Other ways of accounting for it are numerous; and a case in point is where the manager was under the impression that a new and green bench could be taken from dead-cold and be got hot enough to make gas in 24 hours. Also I have seen a case where a superintendent was told to let some full-depth benches down temporarily; and he had the retorts quite cold in 24 hours after they were making gas. In the majority of cases foremen on works, or outside foremen who might at any minute have to take temporary charge of a retort-house, do not know the nature or use of the seal in the mains. Time after time I have seen a big stream of water running continually into the hydraulic main; and then some complaints would be sent about the accumulation of pitch.

I remember when writing-up a large English gas-works being greatly astonished at finding reports in the monthly accounts dealing with the operations some 45 years before, in which statements were made as to the quantity of ammoniacal liquor "run into the river." This, indeed, seemed an interesting record of ancient history; but it is nothing compared to the way they do things in the South-West. It is hardly conceivable, perhaps, but nevertheless a fact, that in the city under notice, not only liquor, but tar also, was, until recent months, run into the sewer.

In that works they supply gas under a pressure of 5 lbs. per square inch. The gauge was not all that could be desired, as on a number of occasions furious complaints would be made about the pressure, and the stoker persistently swore to there being as high as 6 lbs. on. Eventually, it was found the gauge would not record below 6 unless it was given a knock; so the stoker was kept busy agitating it. He usually had a good flame on the jet-photometer, as, if the candle-power got low, he would screw the burner off and push a hat pin through it. They had another novel way of making gas quickly and enriching it. This was to pack 15 lbs. of resin in a paper bag and after every (say) five shovels

of coal put into the retort, a bag of resin would be thrown in. The firework display was then certainly magnificent.

Before the new bench was put in, one of the engineers rigged up what the men called a "sargan" mill. [My spelling is phonetic.] "Sargan" is a kind of treacle or molasses; and the name was intended to signify the product of this gas-machine. The principle was to have a number of 1½-inch pipes built over a coke-furnace, and covered with a plain arch. In each pipe there were built five ¼-inch pipes, with blank ends, which were merely to fill up the fall in the 1½-inch pipes, and make a larger heating surface for the crude oil which was pumped into the 1½-inch pipe (and consequently round the five ¼-inch pipes). Steam also was admitted to the gas-oil pipe; and the gas was then led to the pipe at the outlet of the exhauster. This arrangement, with about ten pipes 8 feet long, made gas at the rate of some 7000 cubic feet per hour. It made things quicker all round, as the stove men had to rush about the town to adjust all the stoves about six times a day.

I have said something for and against the American style of doing work. You have heard a lot about the speed of American workmen when you expressed surprise at the rate of wages paid. In the majority of cases, this greater pressure, at which it is claimed the men work, really does take place. At this works, we had to tear out a setting of six retorts, 16 in. by 28 in. by 9 ft. 3 in. half-depth regenerators, in an 8 feet space arch. On one Saturday at 4.30 p.m. the bench was making gas. But by Sunday at 4.30 p.m., ten men had pulled out the whole of the retorts and setting, and had hauled out and cleaned up the ironwork and brickwork. With one mason and one helper, we prepared the furnace and put in new covers, laid the retort tiles, and set the two lowest retorts by Monday night. On Tuesday at 8 p.m., all the retorts were in place; and on Wednesday, the wall was built up and the ironwork put on. On Thursday a slow fire was started; and on Friday at 3 p.m.—six days after the old retorts were making gas—the new retorts were in use on six-hour charges. On Saturday, the bench was on four-hour work; and the heats were certainly lovely. Three weeks after this, the face of the bench was perfectly tight, all the retorts were without a single crack, and the regenerators were in sound condition. This shows what can be done, when absolutely necessary. On both sides of the repaired bench there were retorts in full work; but not once did I hear any swearing from the stokers on account of interference. During the time this work was being done, the shade temperature in the town was from 96° to 98° Fahr. at 2 p.m. By calculation, I figured out the mason was working at the rate of about 2000 bricks a day of ten hours. His wages are 55 c. per hour, or equal to 20s. 10d. per day. The helper was paid 30 c. per hour.

USE OF COKE-OVEN GAS AND THE CONTROL OF ITS CALORIFIC POWER.

Under the above title, Herr H. Fahrenheim, the Engineer of the Municipal Gas and Water Undertaking at Essen, describes the various stages of an investigation which have finally enabled him to design an automatic instrument for continuously recording the calorific power of coke-oven gas. Herr Fahrenheim remarks that some such appliance is necessary if coke-oven gas is to be mixed with coal gas for the purposes of a public supply, because the former varies very much in quality from time to time. Jet photometers have hitherto been employed in factories for gauging the quality of coke-oven gas; but their readings are too much affected by the pressure and the specific gravity of the gas to be trustworthy, while calorimeters of the Junkers pattern give occasional instead of continuous results.* The author has therefore attempted to ascertain whether a gas-flame cannot be caused to burn in such conditions that the temperature it yields is an accurate function of the calorific power of the gas consumed.

The heating power of a flame depends on three factors: (1) The calorific value of the gas, (2) the volume and heat capacity of the combustion products, and (3) the cooling action of the air round the flame. The first of these factors is governed by the composition of the gas; while the third is purely extrinsic, and can be converted into a constant by keeping the flame within a closed apparatus. The question at issue, therefore, is simply whether the quantity of, and heat contained in, the products of combustion of a gas are strictly proportional to the constitution of the original gas when all necessary measures are taken to supply the flame with no more than the proportion of air theoretically required to ensure perfect combustion.

On examining four specimens of coke-oven gas evolved from the same fuel at different stages of the carbonizing process, it was found that their gross calorific powers, in terms of large calories per cubic metre, were 5095, 5235, 5460, and 5595 respectively; the corresponding total percentages of combustible carbon compounds in them being 38·6, 39·75, 41·4, and 43·4. These calorific values stand to one another in the ratio 10 : 10·27 : 10·71 : 10·98; whereas the carbon compounds are as 10 : 10·29 : 10·72 : 11·24. This shows a certain agreement; but the system of comparison is not precise because the two chief components of the "heavy hydrocarbons," ethylene and benzene vapour, differ largely in proportion as well as in calorific power. Hence some method of separating the benzene from the ethylene must be employed—some process that is capable of being carried out very rapidly in laboratories not equipped with every form of gas apparatus. [The plan adopted by the author is described below.]

With the aid of this process for differentiating between the two chief constituents of the "heavy hydrocarbons," four different kinds of gas were tested; III. being a coke-oven gas, IV. a coal gas, II. a mixture of coal gas with coke-oven gas, and I. a coal gas made with an abnormal proportion of air. The figures relating to each constituent of the gases are recorded in Table I., where the data referring to the calorific powers are left in their metric units. Table II. shows the volumes of carbon dioxide and

TABLE II.

Original Constituent.	Combustion Products.	Volumes. I.	II.	III.	IV.
C_2H_4	CO_2	3·00	2·22	2·58	5·44
	H_2O	3·00	2·22	2·58	5·44
C_6H_6	CO_2	8·58	8·64	10·08	7·56
	H_2O	4·29	4·32	5·04	3·78
CO	CO_2	8·44	6·38	5·85	8·08
H	H_2O	43·75	43·76	46·00	48·70
CH_4	CO_2	30·00	35·34	34·60	34·35
	H_2O	60·00	70·68	69·20	68·70
	Totals	161·06	173·56	175·93	182·05

of water vapour (it is assumed throughout that the water remains gaseous) formed on combustion of each constituent, and also the respective totals. If the totals given in the two tables are collected and expressed in relative values, the annexed relationships are obtained:

	I.	II.	III.	IV.
Relative gross calorific powers	10	10·75	10·98	11·32
,, nett ,, ,,	10	10·74	10·96	11·30
,, volumes of combustion products	10	10·78	10·92	11·30

This proves that the quantities of combustion products are proportional to the calorific powers of the original gases. A parallel calculation might be offered to show that the amount of heat contained in them is likewise proportional; but that is unnecessary, as experiments carried out for several days at a time with a thermometer placed in the outlet of the author's apparatus, have demonstrated that the temperature is sensibly an exact function of the quality of the gas burnt.

The apparatus accordingly consists of a chamber of specified dimensions enclosed in a case. Gas is consumed in it at an exact pressure of 20 millimetres of water column, and at a rate, when the specific gravity is about the normal, of about 20 litres per hour. The heating effect is recorded by a pyrometer on a revolving diagram about 6 inches wide, and as the apparatus can be used for gases having nett calorific powers ranging between 800 and 5500 large calories per cubic metre [90 to 620 B.Th.U. per cubic foot] small variations are rendered quite

* The continuous self-recording calorimeter recently devised by Professor Junkers had not been described when this article was penned.

TABLE I.

	I. Per Cent. by Volume.	I. Calorific Power. Gross.	I. Calorific Power. Net.	II. Per Cent. by Volume.	II. Calorific Power. Gross.	II. Calorific Power. Net.	III. Per Cent. by Volume.	III. Calorific Power. Gross.	III. Calorific Power. Net.	IV. Per Cent. by Volume.	IV. Calorific Power. Gross.	IV. Calorific Power. Net.
CO_2	1·50	—	—	2·40	—	—	2·60	—	—	1·40	—	—
C_2H_4	1·50	224	209	1·11	166	155	1·29	193	180	2·72	406	380
C_6H_6	1·43	494	473	1·44	497	476	1·75	605	579	1·26	435	417
O	0·35	—	—	0·23	—	—	0·35	—	—	0·58	—	—
CO	8·44	257	257	6·38	194	194	5·85	178	178	8·08	246	246
H	43·75	1340	1137	43·76	1340	1137	46·00	1410	1195	48·70	1493	1265
CH_4	30·00	2860	2575	35·34	3365	3030	34·60	3295	2965	34·35	3275	2945
N	12·80	—	—	9·25	—	—	7·33	—	—	2·80	—	—
Totals	99·77	5175	4651	99·91	5562	4992	99·77	5681	5097	99·89	5855	5253

conspicuous. An apparatus of the kind described was installed at the Essen works at the end of 1906, and has proved satisfactory. By its aid irregularities in the composition of the coke-oven gas are at once brought to notice, and a telephonic message to the ovens enables a change to be made so quickly that the combined coal gas and coke-oven gas sent into the distributing system is practically constant in constitution and properties.

ESTIMATION OF BENZENE AND ETHYLENE.

The author's method of differentiating between the benzene vapour and the ethylene in the so-called "heavy hydrocarbons" is a process of calculation from the amount of carbon dioxide formed on explosion. The carbon dioxide is first removed from 100 cc. of the sample of gas. About 13 cc. of the residue are exploded with 87 cc. of air, the carbon dioxide produced is absorbed, recalculated for 100 cc. of gas, and termed a. The remainder of the gas residue is then separated into heavy hydrocarbons and the other usual constituents; all the figures being recalculated for 100 cc. of the original gas. Now, since carbon monoxide and methane both yield equal volumes of carbon dioxide when exploded, if from a is deducted the proportion of $CO + CH_4$ in the gas, the difference b is the amount of CO_2 yielded by the heavy hydrocarbons. As one volume of ethylene gives two volumes of CO_2 and one volume of benzene vapour gives six volumes of CO_2 on explosion, it may be said that

$$6C_6H_6 + 2C_2H_4 = b\ CO_2,$$

$$\text{whence } C_6H_6 = \frac{b\ CO_2 - 2C_2H_4}{6}.$$

$$\text{Since } C_6H_6 + C_2H_4 = C_nH_m, \text{ or } C_6H_6 = C_nH_m - C_2H_4,$$

$$\text{by substitution } \frac{b\ CO_2 - 2C_2H_4}{6} = C_nH_m - C_2H_4;$$

$$\text{whence } C_2H_4 = \frac{6C_nH_m - b\ CO_2}{4}.$$

AS OUR GAS FRIENDS SEE US.

[From the "Electrician."]

[This article from the "Electrician" may be reprinted as it stands without comment further than to point out that, in regard to cost, our contemporary has made comparison between a flame arc lamp and an ordinary gas mantle, and to suggest, in connection with the last paragraph, that before writing on the subject again a study should be made of the report on experiments as to the contamination of air by the combustion of coal gas, by Mr. Otto Hehner and Dr. Samuel Rideal, as submitted in 1904 to the Board of Trade Committee on Gas Testing, presided over by Lord Rayleigh.—ED. J. G. L.]

It is generally well to "see ourselves as others see us," more particularly if others see us in the true light. At the present time our gas friends are very anxious that we should see ourselves in what they consider the true light; but there is a strong inclination on the part of electrical engineers to consider that this supposed true light is in reality very faulty. As a matter of fact, statements which have recently appeared in the Technical Press identified with the gas industry are so very far from being correct, that we think it is well to call attention to some of them, otherwise the public may think electrical engineers have nothing to say in reply, and may come to believe that the views expressed by our gas friends are indeed made in the true light of facts.

Much is often made of the advantage to be gained by the subdivision of light into small units for the purpose of general lighting. There is, of course, a certain advantage in doing so which is obvious to most people—the advantage being that the illumination produced is more even. There is, however, the physiological effect, which is often forgotten. For example, it is not uncommon to find a public hall illuminated by incandescent lamps (we do not necessarily refer to gas-lamps) not far removed from the floor level. The lamps are of comparatively small candle power, they are not spaced far apart, and the illumination is very uniform. Nevertheless, the result from the illuminating point of view may be very bad, because it is impossible to look anywhere in such a hall without having several sources of light in the field of view.

These conditions apply more or less to street lighting, as well as to interior lighting. Streets are often illuminated by means of incandescent gas-lamps spaced at comparatively short intervals. The illumination produced is fairly uniform, but the lamps are not far removed from the street level, and consequently pedestrians have them constantly in the field of view. The effect on the eye, therefore (which effect, when all is said and done, is the one that must be considered), is apt to be bad. On the other hand, if the gas-lamps are replaced by flame arc lamps at a considerable height above the street, it is possible that the illumination may not be so even, but the physiological effect is apt to be better, because the nearest arc lamps are likely to be out of the field of vision. Moreover, the intrinsic brilliancy of the flame arc lamp is low in comparison with many gas-mantles used in street lighting; the result being that the eye may be directed to a flame arc lamp with less fatigue than to a gas-mantle at the same distance, and, further, the effect on the eye is probably the less fatiguing as the luminous area increases.

There have been many criticisms made by our gas friends on the experimental lighting in the City of London. Generally speaking, these criticisms are so trivial that they are scarcely worth attention. One of the chief complaints seems to be that dark shadows are produced occasionally as traffic passes a lamp, and that the lamps are placed high up where the light is not required. We fear that shadows will always be produced in streets which are artificially lighted, but we do not think that they can be described in any sense as a serious objection; and with regard to the lamps being high up, it is generally recognized that the higher the lamps can be placed the better the result must be. If only the question of cost and other engineering limitations did not prevent it, better results would be obtained by putting very much more powerful lamps very much higher, in imitation of the sun itself. We have never known anyone to complain that the sun was situated too high up for illuminating purposes, though the sun is liable to produce unsatisfactory results when it is low down. It is sometimes forgotten that by placing lamps high up we are able to produce illumination equally even in character as with lower-powered lamps fixed at a lower level and nearer together. High-pressure gas is brilliant; but it is often an eyesore, physiologically speaking, because the mantles are not placed sufficiently high above the street level. In many ways centre street lighting by means of suspended lamps is an ideal method, as it gives good general lighting, and permits the lamps to be fixed cheaply at any height that may be found advantageous. The criticism made by the "JOURNAL OF GAS LIGHTING" that the trimming obstructs the traffic, is not a serious one, because trimming can be arranged to be carried out at the roadside if desired. The present arrangements are merely experimental.

Of course, the final criterion must always be that of cost, assuming that the illumination by two different illuminants is equally good. As far as the cost per candle-power-hour goes, the flame arc lamp is easily ahead of its rival. Thus, tests of the Crompton-Blondel flame arc lamp at the Devonport Dockyard show that a mean hemispherical candle power of 2200 was obtained for a consumption of 400 watts. If the price per unit is taken at 2d., which is a fair price for outdoor lighting, this is equivalent to 0·00036d. per candle-power-hour. The figure often given for gas-mantles is 20-candle power for a consumption of 1 cubic foot of gas per hour. If mean spherical candle power were taken, the figure for candle power for the gas-mantle would presumably be diminished; but even if 20-candle power be taken, and gas at 2s. 6d. per 1000 cubic feet, the cost per candle-power-hour works out at 0·0015d., or about four times that of electricity. In one case the cost must be increased by that of the carbons and trimming, and in the other by the cost of mantles and attendance; but even so the cost per candle-power-hour for the flame arc lamp is decidedly less than that for incandescent gas. These figures may be useful as far as they go; but in actual street lighting we must, of course, take the total annual cost of the two systems, and here there is always the difficulty of deciding just where one system is equal from the illuminating point of view to the other before the cost is determined. We hope to give some figures as regards this point shortly.

Probably one of the most curious claims put forward in favour of gas lighting is one attributed to Professor Vivian B. Lewes, though we can scarcely believe that he originated it—viz., that the products of combustion of gas-burners in a room are carried upwards by the heated air, and are diffused through the plaster ceiling above, with the result that the atmosphere of the room is much more healthy than it would be if no gas were used. We do not know what happens to the occupants of the floor above, or whether the diffusion takes place equally when the ceiling is papered, as is often the case; but we think that common sense and common experience prove that the atmosphere of a room is not rendered more healthy by the burning of gas therein. We have never heard of gas being burned in daylight with this object in view.

NEW PLANT AT THE COWDENBEATH GAS-WORKS.

Before a goodly company of gentlemen interested in the gas industry, the Cowdenbeath Gas Company last Tuesday inaugurated some new plant which has just been added to their works, and which may be taken as the outcome of a spirit of enterprise of a very high order. Cowdenbeath is at present at the very "hub" of the Fife coalfield, which, since coal-getting in Lanarkshire began to show indications of giving out, has experienced an exceedingly rapid development. Cowdenbeath has kept pace with this development. Gas has been made and supplied in it for about twenty-one years; but the business was a languishing one, and was, as a matter of fact, on the verge of extinction, when, six years ago, a body of gentlemen who were satisfied that there were possibilities in the concern acquired the interest of the then shareholders, and, having put fresh capital into it on a liberal scale, the Company, as "revivified," entered upon a career of progress which has been uninterrupted, and which gives every indication of being far indeed from reaching a terminus. Six years ago the works were at the back of the town, and much out of date. A new site was procured, alongside the railway, in connection with which there was already a siding. The Company were fortunate in securing, at that time, the services as Manager of Mr. J. B. Scott, formerly of Innellan. Mr. Scott came on the scene in time to superintend the erection of the new works, which he carried through in a capable manner;

Mr. A. Waddell, of Dunfermline—a neighbouring town—being the Consulting Engineer. Not much of a very high order was attempted in the new works; but now, fortune having smiled upon the Company, and their business warranting it, the Directors have felt justified in introducing in the manufacturing department plant of a sort which is not yet to be found in any works of the size, and which anyone with a trained eye must see cannot fail to add to the efficiency of the works, and to lead to greatly enhanced economy in their operation.

The retort-house is not a large one, but it is capable of easy extension. The bench consists of three ovens, with settings of eight, six, and four retorts respectively. At present the last is the reserve. The new plant in the manufacturing department consists of a coal and coke handling installation, upon the method evolved by Mr. A. Waddell, which has since been adopted at Renfrew and Perth. The guiding principle of the method is the provision of railways, at various levels, with a hoist, worked by hydraulic power, for the raising and lowering of the hutches carrying the materials. For the provision of this power there is a steam-engine, which works automatically, in a way that will be well understood. The coal used in the works is all procured in the neighbourhood; and for its conveyance, the North British Railway Company have provided a service of 5-ton hopper-bottomed waggons. These are run into the works, and the coal is dropped from them into a fixed hopper. It may be explained that any large coal which comes in is broken by hand, and all the coal, broken and unbroken, goes into the hopper. At the bottom of it there is a tunnel, which, with its ramifications, communicates with all parts of the coal-store and the coke-yard. Coal, therefore, coming in, is received in a hutch at the bottom of the hopper.

The Coal-Hoisting Plant at the Cowdenbeath Gas-Works.

The hutch is then run along the tunnel to the hoist, and elevated to the highest level railway, along which it is run till it reaches the place where the coal is to be discharged. There are four of these in the length of the overhead railway, each with a shoot into the coal-store (through the roof). To whichever shoot is desired to be used, the man in charge runs the hutch, and, by an automatic arrangement, the bottom opens, and the contents are discharged in two or three seconds. The different classes or mixtures of coal can thus be deposited at four different places in the store, which is capable of holding 200 tons.

In the retort-house the charging and drawing are done by hand; but the coal to be used is procured by an arrangement similar to that of the deposit. There are four tunnels—one below each class of coal—and by these a barrow can be filled with any desired class, and wheeled on to the charging-floor. The firing is done on the regenerative system. When the coke is drawn, it falls through the stage-floor into a Waddell quenching chamber, constructed by Messrs. Robert Dempster and Sons, Limited, of Elland—the first of its kind to be made. This holder is a cylindrical drum, upon wheels, with an opening on the top side, through which the coke falls. Water is then sprayed into the chamber, and when the process is completed the quencher is run along, turned upside down, and the coke falls into a hutch, which is then taken to the hoist, elevated, and run along to the place where it is desired to tip it. When the coke is tipped, it falls into a revolving screen, which sorts it out, and deposits it into a large hopper, capable of containing four railway waggon loads, thereby facilitating the process of loading, or it can be dropped without being screened into the coke-yard, from which it can be returned by the underground tunnel and the hoist to the screen and railway hopper. By means of this railway hopper, a waggon can be loaded in a few minutes.

It is almost impossible, without illustrations, to give an adequate description of the plant; but it is calculated that by its use one man is capable of doing the work for which ten or twelve men were before required. A feature of the plant which is new ought to be mentioned—namely, that in the descent of the hutch in the hoist, after it has discharged its load of coke, the escaping energy is harnessed on to machinery which operates the revolving screen, and thus the screening of the coke is accomplished by means of energy which would otherwise be lost; and if the descent of the empty hutch should not accomplish the full screening, the ascent of the next full hutch completes the work.

Another extension has been the erection of a new telescopic gasholder of 100,000 cubic feet capacity, on the spiral diagonal plate guided principle, with provision for another lift, to increase the capacity to 160,000 cubic feet. The Contractors for this work were also Messrs. Robert Dempster and Sons.

Inaugural Ceremony.

When the visitors were assembled, the Chairman of the Company—Mr. JAMES HUTTON, of Edinburgh—extended the welcome of the Directors to them. He said the Company, since it was reconstituted, had been highly favoured on every outstanding occasion connected with it. When the works were started, Provost Mungall performed the opening ceremony; and he held out high hopes regarding them—saying there was a demand in the district for a supply of coal gas. This had been borne out by what had happened since. At that time the Company had 73 consumers; there were now between 1600 and 1700. The works were put up to cope with the needs of the district for a considerable time; but recently the Directors had had to undertake extensions. Their Manager (Mr. Scott) had told them that another winter could not be faced without more accommodation; and consequently they had provided a new gasholder, which had been put up by Messrs. Robert Dempster and Sons. The other plant they had erected was a big thing for works so small. Possibly the like had never been attempted in works of the size. In conclusion, Mr. Hutton, on behalf of the Company, presented a silver flower and fruit stand to Bailie Barclay, for Mrs. Barclay, and called upon him to perform the opening ceremony.

Bailie Barclay and the Directors entered the cage, and set it in motion. As it moved up, it cut a ribbon. The party then descended and proceeded to the gasholder, where Bailie Barclay turned on the gas to the town, and was presented by Mr. J. W. Broadhead, on behalf of Messrs. Dempster, with the aluminium wheel with which the valve had been opened. In doing so, Mr. Broadhead expressed the opinion that in a few years similar gasholders to the one just completed would be universal. He briefly explained the working of the holder—dwelling chiefly upon the arrangements for keeping it level, which, he said, were found to work satisfactorily in all cases.

Dinner was afterwards served in the Crown Hotel—Mr. HUTTON presiding.

Mr. G. B. TWEEDIE, solicitor, of Edinburgh, a Director of the Company, proposed the toast of "The Provost, Magistrates, and Town Council of Cowdenbeath." He said the town had in 1881 a population of 2700, but it was now upwards of 10,000. In 1899 the rental of the burgh amounted to £12,800; it was now £24,500. It had doubled in eight years. He questioned if there was a burgh in Scotland which had advanced so rapidly.

Bailie BARCLAY, in responding, said that the Gas Company deserved credit for their work. They had not kept the burgh in suspense, as another company did, which came among them with a great flourish of trumpets. The Town Council proposed to inquire into the price of the works they had had the pleasure of seeing that day; but they had not yet made up their minds upon the subject.

Dr. CRAIG proposed "The Cowdenbeath Gas Company." He said he considered the Company had conferred a very great boon upon the people. In going his rounds, he could see the gas was used to a large extent for cooking; and he was convinced that much good was being done in this direction.

The CHAIRMAN, in responding, said he was not aware that the Company were so popular. When the present contributories took over the concern, nobody seemed to want it. It was offered to the Council, but they would not look at it. Certain individuals thought something could be made of it; and the result was what the visitors had seen that day at the works. The Directors, however, had little to do with making the Company a success. Those who had contributed to its success were the officials—Mr. Scott, the Manager, and Mr. Terris, the Secretary. They heard some talk about the Council acquiring the undertaking. This was the business of the Council, not theirs. The Company were quite pleased to go on as they were doing; they did not intend to stop. When the Company began business twenty-one years ago, their make of gas was ¾ million cubic feet per annum; whereas now it was nearly 21 millions, and in another six years it might be 42 millions.

Mr. J. H. BENNET, of Edinburgh, proposed "The Contractors," to which Mr. J. W. BROADHEAD, on behalf of all the firms, responded.

Mr. A. MACKENZIE, of Edinburgh, proposed the toast of "The Gas Profession."

Mr. W. BLAIR, of Helensburgh, in acknowledging the toast, said the profession had made more progress during the past six years than in any similar period of its existence. He was delighted to come to see the inauguration of the new plant, and he thought the large number of gas managers present showed the interest which was being taken in the subject of mechanical appliances.

Mr. SCOTT, the Manager, in a few remarks, expressed his thanks to the Contractors for the cordiality which they had carried through their work.

Mr. C. FAIRWEATHER, of Kilmarnock, proposed the health of the Chairman; and the proceedings were brought to a close by the singing of "Auld Lang Syne."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Wage-Earner or Partner.

SIR,—Mr. Norton H. Humphrys' article in this week's "JOURNAL," on the above subject, contains much in favour of co-partnership which I fully appreciate; but in the lower half of the first column on p. 838 of the "JOURNAL" there is a misunderstanding which I must ask your leave to correct.

Mr. Humphrys says: "All these considerations tell in favour of the co-partnership system. But we now come to what in most cases constitutes the chief difficulty; and it is the necessity for weeding out. It is admitted that the scheme. . . . was not a success when bestowed on all alike. This implies that certain ineligibles must go out . . . One cannot avoid a word of sympathy for some of the ineligibles. They are not all indolent, dishonest, given to beer, or otherwise objectionable, but may be physically or mentally incapable of taking up the quicker stride demanded. And this especially refers to men who are advanced in years." At this last sentence I stop, and will make no comment thereon. The remainder of two long paragraphs further magnifies a purely imaginary difficulty.

The misunderstanding appears to have arisen from the statement in my paper that "any co-partner who is careless or indifferent . . . must be told, when his agreement expires, that it will not be renewed until he improves, and that then he may apply for a renewal, which should be given for say three months, instead of the usual twelve. If he does not improve, he gets no new agreement, and his ultimate fate is to leave.

It is not before, but after co-partnership is started and in full working that this discrimination must be exercised in the renewal of agreements which at starting are offered to every regular man. The indifferent workmen are not discharged. They are cautioned—with good effect in many cases. When cautioning fails, agreements are stopped for a time—also with effect. The result is that nearly all the indifferent men are converted into good workmen, and very few indeed are ultimately discharged. The great difference is that, whereas by the old system bad workmen had to be "weeded out," co-partnership has succeeded in converting a very large proportion of them into good, thrifty men.

I thank Mr. Humphrys for his "word of sympathy" for some of the ineligibles, and can assure him that the responsible officials of the co-partnership companies are not wanting there, and they have their reward.

Mr. Humphrys thinks "the average worker would need to be instructed from the A B C on the question of partnership and thrift," and he says "one method of introducing it might be to begin at the top, with the manager and chief officers, and to let the thing gradually filter down." The best and only way to instruct the ordinary workman in co-partnership principles is to start the system straight away. We have all found him a very apt learner. To begin at the top would be worse than useless. No one teaches the A B C of the alphabet in that way; and the A B C of co-partnership will never in that way be learnt. The top and the bottom, and all between, must be included at the start. Then all will have an equal and joint interest in working together to the advantage of themselves and the company.

Dec. 19, 1907. GEORGE LIVESEY.

SIR,—Mr. Norton H. Humphrys has, I think, misunderstood one attribute of co-partnership which was mentioned, only to be cleared up, in the discussion on the recent paper read by Sir George Livesey at the Southern District Association meeting. Mr. Humphrys says in his article that the admission of all workers in an undertaking to co-partnership implies that certain ineligibles must go out and other more suitable workers take their place, and that the ineligibles may be physically or mentally incapable of taking up the quicker stride demanded, especially when advanced in years. I do not hesitate to say that a man will take greater interest in his work, whether he is an old or a young man, a slow or a quick one, by reason of his becoming a true co-partner; and that one respect in which co-partnership differs from all the other methods of managing the industrial side of an undertaking is that it does not weed out undesirables, but educates all alike in an endeavour to make their services desirable and desired. The average workman cannot have a greater interest in his employer than the latter's ability to meet the obligations of pay-day. But when he becomes a shareholder, his interests in his employment widen, and he regards them from another standpoint than that of the mere wage-earner.

I must apologize for troubling you with this letter; but I could not let Mr. Humphrys' suggestion go unchallenged, that progress is achieved by "weeding out" (to the detriment of others), instead of by education which makes the workman a better citizen into the bargain.

South Metropolitan Gas Company, CHARLES CARPENTER.
709, Old Kent Road, S.E., Dec. 21, 1907.

SIR,—Mr. Humphrys' article in your last issue appears to have been written in ignorance of what Sir George Livesey said in the paper he read at the Southern District Association meeting, and in the discussion which followed. Sir George did not limit himself to one aspect of the question, but dealt with every phase of it, and also with the difficulties which have since presented themselves to Mr. Humphrys, showed how they are overcome, and made the working of the system clear, I should think, to everyone.

It would take up too much of your space were I to attempt to correct all Mr. Humphrys' misunderstandings; but there is one point which I should like to make clear to him. He is under the impression that the "chief difficulty" in the way of the co-partnership system is the "necessity for weeding-out ineligibles;" and he goes on to assume that men advanced in years who are "physically or mentally incapable of taking a quicker stride" must be weeded out, and all responsibility for their rejection shelved. After Sir George's statement in replying to the discussion, that, instead of weeding out indifferent men, the system converted them into good workmen, which had been done in numberless cases, further explanation should be unnecessary. However, let me say that no men in the South Suburban Gas Company have been discharged on account of their physical or mental incapacity to take a quicker stride; and no man in any works need be as a consequence of co-partnership. All that is required of any man is that he should do his best. It is only the incorrigibly lazy or careless men, who resist all appeals for improvement, that, in the end, have to go. There are not many of these in any well-managed works; and there is no difficulty in dealing with them without the intervention of the Chairman or the Directors.

Mr. Humphrys is quite right when he says that the success of co-partnership can only be obtained by the combined efforts of all, and that a full appreciation of its advantages and obligations does not come at one stroke. It is a matter of education and experience, demanding, as in all other education, patience and perseverance on the part of the teachers. But it must have a start; and I would assure Mr. Humphrys, and others who have the interest of their fellow-workers at heart and would lift them up to a higher level, that they need not hesitate to begin. Success is assured. What has been done here and at the South Metropolitan Gas-Works and elsewhere, can be accomplished by others; and I hope that a great many will soon adopt the system. I know of two companies who are about to do so.

South Suburban Gas-Works, SYDNEY Y. SHOUBRIDGE.
Lower Sydenham, S.E., Dec. 21, 1907.

SIR,—I observe in this week's issue of the "JOURNAL," an article headed "Wage-Earner or Partner," which deals with the paper read by Sir George Livesey at the recent meeting of the Southern District Association of Gas Engineers.

There is a paragraph which states that the chief difficulty in the partnership system is the necessity for weeding-out ineligibles. As the Company I serve have adopted a profit-sharing system, I should be glad if you would afford me this opportunity of stating that all permanent employees of the Company are eligible for admission into the profit-sharing scheme, and the inauguration of the scheme in no sense involved any weeding-out. Old and young employees of the Company alike have been freely admitted—no discrimination between them being made.

Commercial Gas Company, STANLEY H. JONES.
Stepney, E., Dec. 19, 1907.

SIR,—With reference to the article on "Wage-Earner or Partner," by Mr. Norton H. Humphrys, in the last number of the "JOURNAL," may I be allowed to state that, not only is the co-partnership scheme as set forth in Sir George Livesey's paper "a large and far-reaching social question by being financially a success," but in addition it is a moral advantage?

Under a well-arranged system of co-partnership, the wage-earner lifts himself out of a condition in which he is continually combating in a hand-to-mouth sort of style of living, always on the border line of poverty, to become a partner in the concern in which he is employed. When the worker is relieved of such an anxiety, and hope takes the place of despair, he becomes a more cheerful worker, and consequently more effective. Surely Mr. Humphrys is not living in such a "fool's paradise" as to think that only one in nine of the whole body of employers and workers is in antagonism. Reverse the order, and we shall be nearer the truth. As a worker, allow me to inform the writer of the article that co-partnership, wherever it exists—and there are a large number of examples, not only in this country, but also on the Continent—always bears the same testimony, that antagonism between Capital and Labour is eliminated. Why? Because the labourer is made a capitalist, and responsibility is attached to his every action. He can no longer say it is not his business to "avoid waste," and look on and "see an unnecessary smash" now and then, "because it helps to make work." As a co-partner, I can confirm what the writer says further on—"that the partner not only fulfils his daily task, but in addition has an eye to the interest of his employer." Why? Because he becomes his own employer. He has a direct interest in his work to prevent waste of materials or undue wear of tools. This is the feeling that co-partnership creates. It acts and reacts upon all. It not only permeates throughout the whole of the staff, but it extends to the body of workmen, and makes it easier to run a gas-works. The writer goes on to enumerate likely methods of securing reliable workers. Why go such a roundabout way? If the methods mentioned and the considerations spoken of tell in favour of the partnership system, why not adopt it? If the weeding out constitutes the chief difficulty, that is easily overcome.

The principle adopted by the South Metropolitan Gas Company respecting those who do not come up to the standard, is not to turn them adrift. We give them that word of sympathy spoken of by the writer. I have known, after a lapse of time, men to become earnest co-partners, following friendly counsel from the Engineers, and from those who have charge of the working of the system. Allow me to assure Mr. Humphrys that, when the aged are turned adrift from the Company mentioned, it is with the provisions of an old-age pension. Also, I can assure the writer that the many difficulties he contemplates arising are only imaginary. He must not withdraw that sympathy which he could not avoid giving to some of the ineligibles higher up in his article. When he comes to make such a short step from wage-earner to that of partner for the manager and chief officers, to the exclusion of the rank and file, what a fruitful cause of discontent there is. The writer says: "One of the parties or classes concerned cannot of themselves ensure success, which can only be attained by the combined efforts of all." Why, I ask, hesitate to take the other step, and include the rank and file? Why put off success by such a delay, if it requires the combined efforts of all to assure success? This is the foundation of the success of the South Metropolitan Gas Company's co-partnership scheme. All are included.

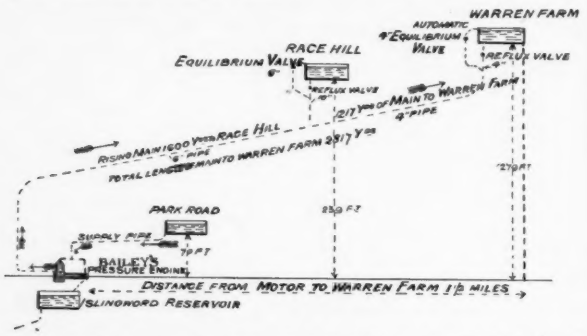
I am pleased to say the wage-earner has learned how to appreciate his opportunity. From about 45 per cent. who were savers at first, practically the whole now are thrifty. It has been a splendid school, and very effectual in inculcating sobriety. Reports come into the Board from the whole of the Engineers of our different stations that at Christmas they now have no trouble, as formerly, with the men through drink. Men well disposed, but weak, we save from the hangers-on. Nearly the whole of the annual bonus is now invested in stock. Mr. Humphrys says in his concluding remarks: "To make a satisfactory partner, he must not only have a clear grasp of the whole question, but be so far convinced of its advantages as to have a keen desire for it." How is this to be brought about unless the men are given an opportunity to show that desire? Would Mr. Humphrys withhold the school until the scholar showed a desire for education? Would the school ever be required? My hope is that co-partnership may find favour with boards of directors, not only in gas undertakings, but also with those controlling every other industry in the kingdom.

HENRY AUSTIN.

East Greenwich, Dec. 20, 1907.

Raising Low-Level Water for High-Level Service.

SIR,—In reply to "Interested" ("JOURNAL," Oct. 29, p. 354) and "Hydraulics" (Nov. 19, p. 576), I beg to state that the system advocated has been carried out at the Brighton Water-Works for the last thirty years. It will be seen by the sketch that the water from a low-level reservoir is used for driving the engine for pumping water to the higher reservoir at Warren Farm.



The sketch showing the distances and heights, &c., explains itself. It needs no further explanation.

This system may be utilized in most towns, where all the large houses are usually built on the high ground. All the water for the supply of the lower parts of the town is conducted through the hydraulic pressure engine to pump to the high houses; the exhaust going into the low-level service reservoirs.

There is another point to be considered—viz., that the engine may be driven by river water (unfit for drinking purposes), to pump the pure and the wholesome drinking water supply.

I know of the same system being carried out for lifting sewage from a low-level tank into the main sewer, the level of which is 100 feet above the tank. The motive power was here obtained from the town's water-main serving the locality.

R. S. V. P.

Dec. 14, 1907.

Steel Tubes for Water-Mains.

SIR,—In your issue of Nov. 5 (p. 439), you published an account by Mr. Gettings of the use of Mannesmann steel tubes for water-mains, in place of cast-iron.

The difficulty of making a suitable service connection in a thin steel pipe is mentioned by Mr. Gettings as having been overcome by the use of a pipe "with a thickened shell from about 2 inches wide." Are these steel pipes rolled with a thickened collar during their manufacture? If so, what additional thickness is found to be sufficient? Or is the thickened shell put on afterwards?

Perhaps Mr. Gettings would be good enough to furnish fuller particulars in respect of this service joint.

T. C. WAY.

Wimbledon, Dec. 18, 1907.

Question as to Coke Sales at Bradford.—It having been alleged that coke below legal weight had been sold by representatives of the Bradford Corporation Gas-Works, the Markets Committee (who have control of the weights and measures department) recently resolved to prosecute the Corporation. Subsequently, however, this resolution was rescinded; and it was decided instead to ask the Chairman of the Gas Committee and the Engineer to furnish an explanation. The Gas Committee deny any knowledge of sales of coke under weight; and the Special Sub-Committee who had the matter in hand declined to allow the Chairman and Engineer to attend before the Markets Committee without the other members of the Sub-Committee also being present.

Complaints of Withington Gas.—Withington ratepayers have presented to the Withington Special Committee of the Manchester Corporation a petition complaining of the quality of the gas supplied in the district. The petition asked the Special Committee to place their memorial before the Lord Mayor and the Gas Committee. "The illuminating power and the quantity supplied," the petition stated, "is infinitely inferior to that which was supplied a few years ago, and is undoubtedly injurious to the eyesight of the consumers and a serious menace to all tradespeople; and the defects complained of are not due to any such matters as corroded pipes, fittings, and faulty meters, as many of us have had these renewed at our own expense, and the result has been no appreciable improvement in the gas in any respect." It was arranged that the matter should be at once brought before the Gas Committee.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, Dec. 18.

(*Before the* LORD CHIEF JUSTICE, *Sir* GORELL BARNES, *and Lord Justice* BUCKLEY.)

United Gas Improvement Company v. Gordon.—A Disputed Monazite Sand Contract.

This was an appeal by the plaintiffs from a judgment of Mr. Justice Bigham, reported in the "JOURNAL" for Jan. 22 last (p. 230).

Mr. RUFUS ISAACS, K.C., Mr. COLAM, and Mr. NEWTON CRANE appeared for the appellants; Mr. MONTAGU LUSH, K.C., Mr. CLAVELL SALTER, K.C., and Mr. BREMNER represented the respondent.

The trial in the Court below occupied fourteen days, and involved the construction of a somewhat obscure contract relating to the delivery of monazite sand. The plaintiff Company, which was registered in the United States with a nominal capital of £8,000,000, had considerable interest in the Welsbach Company; and they brought the action for an injunction to restrain the defendant from committing a breach of a contract dated May 28, 1902, made between him and the plaintiffs, and for damages in respect of breaches previously committed. The defendant is the owner of valuable concessions in Brazil of land on which monazite sand was found, and from which nitrate of thorium, used in the manufacture of incandescent mantles, is obtained. By the contract, he agreed to deliver to the plaintiffs a specified quantity of monazite sand, and to transfer to them certain contracts then in existence between himself and some German firms. The plaintiffs further alleged that defendant agreed not to deliver monazite sand to other persons than themselves, and that if he committed a breach in this respect he would pay to them, as liquidated damages, the sum of £50 for each and every ton so delivered. It was alleged that he had committed various breaches, though this was strenuously denied by him. He pleaded that if he had made any shipments to persons other than the plaintiffs, they were made under and in pursuance of a verbal authority given to Julius Deussen, the agent of the plaintiffs, and the defendant in February, 1903, by one Mason, acting on behalf of the plaintiffs. This authority was said to be confirmed by letter from Deussen to Mason. The defendant further alleged that, by the agreement of May, 1902, the plaintiffs assumed all the obligations and stipulations of certain contracts entered into by the defendant before the making of the agreement for delivery. But, in breach of the agreement, the plaintiffs refused to recognize the legality or obligation of the contracts, and wrongfully refused to be bound by or to perform them, or to allow delivery of monazite to be made under them; and the defendant said he thereupon became entitled to carry out and perform the obligation imposed upon him under the contracts to deliver the sand.

After a hearing extending over the greater part of three days, their Lordships, without calling upon the respondent's Counsel, dismissed the appeal.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Wednesday, Dec. 18.

(*Before Justices* CHANNELL, BRAY, *and* SUTTON).

Ipswich Gaslight Company v. Ipswich Union and Others.

This was an appeal on a special case stated by the Recorder of Ipswich, and it raised the question of the rating of gas-works in regard to the inclusion of prepayment meters, stoves, and fittings in the tenant's capital. The Recorder's judgment was given in the "JOURNAL" for Oct. 23, 1906, p. 255.

Mr. HORACE AVORY, K.C., and Mr. JEEVES (instructed by Messrs. Villiamy and Sons) appeared for the Ipswich Union; Mr. BALFOUR BROWNE, K.C., Sir E. BOYLE, K.C., and Mr. WALTER RYDE (instructed by Messrs. Notcutt and Son) represented the Company.

Mr. AVORY said he appeared for the Assessment Committee of the Ipswich Union, and the appeal raised a question in regard to the rating of gas-works—a subject which for some time had troubled rating authorities. Their Lordships would probably be aware that in the rating of gas-works an arbitrary system had been adopted in order to arrive at the rent which a hypothetical tenant would pay for such a business; and for this purpose the practice had been first to try to ascertain the gross receipts from the business; then to deduct the working expenses, so as to get at the net receipts; and finally to apportion the net receipts between the landlord and the hypothetical tenant. To do this, it had been the practice to calculate the amount of what was called "tenant's capital" which would be required for the business, and, having ascertained it, to allow a percentage on it. This had generally been taken at 17½ per cent. This represented the tenant's share of the receipts. Having arrived at the balance by deducting the tenant's share from the landlord's, the result was supposed to give what was called the gross value of the hereditament, from which were taken the statutable deductions for repairs and maintenance. It had become obvious for some time past that unless this question—in the case of gas-works, at all events—was decided as a matter of principle, the result would very soon be to wipe out altogether the rateable value of the works. Since the introduction of penny-in-the-slot or prepayment gas-meters, the amount of tenant's capital had been so piled up that the result would soon be to make the rateable value disappear. It had been understood for many years that ordinary gas-meters were to be calculated as tenant's capital; it had consequently been assumed that prepayment meters stood on the same footing. Now, however, the matter had gone a step further, and the gas companies said that, in

addition to their supplying prepayment meters to all tenants who desired them, they also supplied stoves and gas-fittings to all the consumers in their district; and the argument of the Ipswich Gas Company was that they found all these things in order to carry on their business. The result was to increase the amount of tenant's capital in the undertaking, and leave hardly anything as rateable value.

Justice CHANNELL: Must not that be because 17½ per cent. is too much? I suppose they get some return for the slot-meters, though perhaps it is not 17½ per cent.

Mr. AVORY said that was one question; but he thought an equally important one was whether such things as stoves and fittings were rightly any part of the tenant's capital.

Justice BRAY remarked that he did not see why 17½ per cent. should necessarily apply to tenant's capital invested in these undertakings.

Justice CHANNELL said it seemed to him that this was where the thing went wrong.

Mr. AVORY thought it might be where it went wrong, but he submitted that it was more a question of law as to whether these things were part of the tenant's capital at all. He should submit that a process by which they produced an absurd result must be wrong in principle.

Justice BRAY asked whether Lord Halsbury, in a rating case in the House of Lords, did not say that they would be dealing with it as a matter of principle when it was really a question of fact.

Mr. AVORY replied that Lord Esher had said that the law of rating was a progressive law, which required to be adapted to modern times and institutions. The present case was just such a one as that. Counsel then read the special case, which set forth that an appeal by the Ipswich Gas Company against the poor rate was heard before the Recorder, and was allowed subject to the statement of a special case. The gross estimated rental of the gas-works was £17,681, and the rateable value was £6000. The Company appealed to have the assessment reduced to £10,367, and the rateable value to £3109; while the receipts gave evidence that the true gross rental was not less than £18,400, and the true rateable value £10,700. Both parties agreed as to the principle of rating; but they differed as to the sum to be taken as tenant's capital, and particularly with respect to the items to be included in, and the amount of, the capital necessary for carrying on the business, and also as to the percentage to be allowed in this respect. The Company's witnesses estimated the tenant's capital at £71,031, of which £8224 was for ordinary meters, £17,750 for prepayment meters, £10,724 for stoves, and £8814 for fittings. On this amount 17½ per cent. was claimed, which came to £12,250 per annum. The respondents' witnesses estimated not more than £32,142 for tenant's capital, including prepayment meters and excluding stoves and gas-fittings. The Company had provided within the past few years prepayment gas-meters, the number of which was constantly increasing, and of which there were then 8535. They also let out cooking-stoves on hire to consumers. They contended that both the prepayment meters and the stoves and fittings were to be considered to have been provided by, and to be the property of, the hypothetical tenant, and to be in the nature of stock-in-trade, and part of the capital which he would have to invest in a business; further, that the value thereof should be taken to be part of his capital for rating purposes, and that in respect to such capital interest was to be allowed at the rate of 17½ per cent., in addition to the cost of repairs, maintenance, and renewals. The respondents traversed this contention, and said that the prepayment meters, stoves, and fittings ought not to be treated as being provided by the hypothetical tenant—that the supply of these things was a voluntary matter, and was at best only collateral to the business of a gas undertaking. They also said that if the meters, stoves, and fittings were to be considered part of the business of a gas undertaking, they must be treated so as to enhance its value as a rateable hereditament, and that in no case ought they to be so dealt with as to be taken into account in estimating the capital required by the hypothetical tenant for rating purposes, and that no allowance for interest ought to be made in assessing the value of the undertaking. They further contended that in this case, excluding the stoves and fittings alone from the tenant's capital, the evidence would support the rate. The Recorder held that the prepayment meters on the consumers' premises should be treated as being provided by, and the property of, the hypothetical tenant; and he took them into account as part of the tenant's capital, in accordance with the case of *The Queen v. Lee*. He saw no distinction in principle or in fact between the case of the prepayment meters and that of the stoves and fittings similarly fixed on the consumers' premises, and he therefore found that they were the property of the hypothetical tenant, and took them into account as tenant's capital in arriving at the gross and net rentals. He therefore reduced the assessment to £13,000 gross estimated rental and £5200 rateable value. The question for the opinion of the Court was whether the Recorder was right in law in his decision that the prepayment meters, &c., ought to be taken into account in estimating the capital of the hypothetical tenant for rating purposes.

Justice CHANNELL remarked that the learned Recorder had not said that he allowed 17½ per cent. on all the stoves and fittings.

Mr. AVORY said they could not tell what figures he had adopted as the actual value, as there was contradictory evidence as to what was the value of the meters and fittings.

Justice BRAY said the Recorder had not left that to the Court.

Mr. AVORY said that was because it was a question of fact. He thought he could satisfy their Lordships that the question he had to argue was one of law. The question of meters had always been so considered; and the Recorder thought he was bound by the decision in *The Queen v. Lee*. He had evidently thought from this case that the meters and fittings must be taken into account as tenant's capital; but he (Mr. Avory) should contend that it did not at all follow that this must be so. He contended that the case referred to only really decided that ordinary meters should be treated as tenant's capital, and then he should say that the prepayment meters were not necessarily or properly part of the tenant's capital itself, and that *a fortiori* stoves and fittings were not part. He should say stoves and fittings were not part because it was not the ordinary business of the gas company to supply them. Their business was to manufacture and supply gas. It was the ordinary business of a plumber or an ironmonger to supply gas stoves and fittings, and fit them up in a house. If a gas company chose, for the purpose of their business, to embark on some other business, because by so doing they were able to promote the sale of their gas, the things employed did not become part of the capital of the gas-works. They might be part of the necessary capital of an ironmonger or a plumber; but they did not become part of the necessary capital of the gas company because they increased the consumption of gas, any more than a number of cottages put up by the gas company would be part of their capital because the occupants used gas.

Justice CHANNELL: Your proposition, as I understand it, is that this is not tenant's capital in a gas company's business, but tenant's capital in another business, and that therefore these things ought not to be included.

Mr. AVORY said that was so. There had consequently been an improper deduction from the amount of rateable value in regard to tenant's capital which was not tenant's capital at all in that business, but was capital in another.

Justice BRAY remarked that the Recorder seemed to have assumed that a fair profit on the meters, &c., was 17½ per cent. It might be that this was too high.

Justice CHANNELL thought that was the whole explanation of any difficulty that had arisen.

Mr. AVORY did not think so, because, whatever percentage they put on, if they kept adding to the tenant's capital the whole rateable value would eventually be wiped out. Counsel then read at length the case of *The Queen v. Lee*, which he said the learned Recorder of Ipswich had wrongly relied upon.

Justice BRAY, in the course of the argument, said it came to this: The Union wanted to rate the profits from this business of supplying prepayment meters, and the difficulty was how they could do it.

Mr. AVORY said he could not tell how it would work out in this case. All they wanted to have decided was the principle of whether these meters ought to come into tenant's capital. If not, no question of percentage arose; but if they ought, a very important one arose. He pressed the Court to help them in this matter on the question of whether these things ought to be included in tenant's capital, as it would be a guide to valuers and other persons in the future. As the case stood, it was quite impossible to know whether the Recorder had taken the whole of the receipts into account and deducted these things on the other side, or whether he had taken a portion of the receipts, or what he had done. Supposing the proper result was that some portion of the gross receipts ought to be taken off on account of this business, he should submit that it was not really the business of the gas company but that of a plumber. In this event, the case ought to be sent back with the opinion of the Court that this was the proper way of arriving at the result. The real question intended to be raised was whether it was part of the business of the tenant of a gas company to supply stoves and gas-fittings, as distinguished from what he said was the independent business which the tenant chose to carry on. This was the point he argued before the Lower Court; and whatever the Recorder might have thought as to this being an independent business, he considered the case of *The Queen v. Lee* compelled him to hold that prepayment meters were an ordinary business of the tenant of a gas company, and therefore it was part of his duty to supply stoves and fittings.

Without calling upon Counsel on the other side to reply, their Lordships gave judgment.

Justice CHANNELL said they were of opinion that in this case the appeal must be dismissed. He was anxious, before giving any judgment, to refer to the case of the *Mersey Dock and Harbour Board v. Birkenhead Assessment Committee* in the House of Lords, because, according to his recollection, it was laid down in that case that all these things were questions of fact and not of law. He could not help feeling that all the matters that were put to the Court in the present case were—accepting as correct the doctrine laid down by the House of Lords—really questions of fact. He should be sorry, however, when parties had stated a case raising questions upon which they wanted the decision of the Court, to give no answer to them, and simply to say they had no jurisdiction to entertain the case. Therefore, while protecting himself in this way, he was ready to give the answer that appeared to him to be right, upon the assumption that this was a matter they were entitled to consider as one of law and not of fact. The question was what rent a hypothetical tenant would give for the premises the Gas Company occupied. Then there arose the question of the allowance to be made in respect of tenant's capital; and the Court was asked to say whether it was right for the Recorder to treat, as he did, the expenditure on prepayment meters, stoves, and similar things—right to treat the money expended on these things as tenant's capital in respect of which an allowance ought to be made. His answer was that if the receipts arising from these articles were in fact brought into the accounts as profits in the gross profits of the business, then it most certainly was right to include them. Otherwise, on the assumption that they were not part of the things which the tenant would pay rent for, they were not rateable. If they brought them into account as part of the profits of the business, and a hypothetical tenant would pay for the premises a rent calculated on the estimate that he would get certain sums of money with respect of these things, then they must bring into account the amount he would have to expend in order to do this. It was incontestable that they must be brought into account in some way; but Mr. Avory said the proper way was to take them out of the receipts. But this was a way of taking them out of the receipts. The question of whether 17½ per cent. was too high was a matter of fact for the Recorder on the figures. The answer, therefore, to the question seemed to be that both these things must be taken into account, because, in point of fact, they had been agreed to be taken as part of the receipts of the business. Mr. Avory's suggestion was that, though this was capital expended for business, it was not for this business, but for some sort of outside business really belonging to plumbers or ironmongers who supplied gas-fittings. If this was the case, then the profits ought not to be in the receipts; but if it was agreed that they were profits of this business, and therefore its receipts, it seemed to him they came in as tenant's capital. As he had put forward other reasons in the course of the argument, it was unnecessary to give a more lengthy judgment. These were the reasons why he thought the appeal should be dismissed.

Justices BRAY and SUTTON concurred.

Mr. AVORY asked for leave to appeal if his clients considered it necessary to do so; and this was granted.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Dec. 20.

(*Before Mr. Justice* BRAY.)

Lucas v. Chesterfield Water and Gas Board.

This case, which was argued on the 6th inst. (see *ante*, p. 783), involved the question whether the Umpire, in assessing the compensation to be paid to Mr. Lucas for a piece of land required for the purpose of a reservoir, was entitled to take into consideration the special suitability of the land for such a purpose. The Umpire (Mr. Wainwright, of Liverpool) had awarded Mr. Lucas £1615; but this was to be reduced by £779 if the Court should be of opinion that the adaptability of the land ought not to be considered. At the close of the arguments, his Lordship reserved judgment, which he delivered to-day.

Justice BRAY, after reciting the facts, and reading the relevant particulars in the award, referred to the Aspatria case, and that of the Countess of Ossalinski, and read passages from the judgments. He then said he thought it would be improper to deprive Mr. Lucas of the benefit of the special adaptability of his land merely because parliamentary powers would have to be obtained before it could be utilized for the purpose of a reservoir. It might be that such powers would be difficult to obtain; but that was a matter for the Umpire, not for him, to consider. It might well be that the land would have a special value owing to the fact that it was likely that, sooner or later, the Board would require another reservoir. It seemed to him impossible to say, as a matter of law, that the Umpire was bound to exclude from his consideration the special value of the land. It occurred to him that if the Umpire thought the District Council could take part of the land without further parliamentary powers, he might not have given sufficient weight to the difficulty which another body might have in obtaining these powers; and therefore he proposed to Counsel that he should see the Umpire, and give him the opportunity, if he thought fit, of altering his figures. To this, however, Mr. Balfour Browne did not consent, because it might prejudice his right to appeal from the present judgment. His duty, therefore, was simply to answer the question put to him by the Umpire; and he did so in favour of Mr. Lucas. The award would consequently stand for the higher sum.

Mr. BALFOUR BROWNE said he did not think he required leave to appeal.

Justice BRAY said he felt certain no leave was necessary; but if it were, he should, of course, give it.

COUNTY OF LONDON QUARTER SESSIONS.

SESSIONS HOUSE, CLERKENWELL.—Saturday, Nov. 30.

(*Before Mr.* R. LOVELAND LOVELAND, K.C., *Chairman, and a Bench of Justices.*)

Metropolitan Water Board and their Assessments.

Borough of Islington.

The hearing of the appeals of the Metropolitan Water Board against the assessments made by certain Unions and Boroughs at the quinquennial valuation of 1905 was resumed to-day; the proceedings being in reference to the appeals entered for the Kent district—Greenwich and Woolwich.

Mr. DANCKWERTS, K.C., Mr. HORACE AVORY, K.C., and Mr. BOYDELL HOUGHTON (instructed by Mr. Walter Moon) appeared for the Water Board. The Counsel for the City of London Union were Mr. BALFOUR BROWNE, K.C., Sir EDWARD BOYLE, Bart., K.C., M.P., and Mr. WALTER C. RYDE (instructed by Messrs. James White and Leonard). Mr. BALFOUR BROWNE and Mr. WALTER RYDE appeared on behalf of the Greenwich Union; Mr. WALTER RYDE, Mr. COX SINCLAIR, and Mr. BICKMORE, for the Woolwich Union; and Mr. MORTEN and Mr. SAUNDERS, for the Borough of Islington.

Mr. MORTEN, addressing the Court, said the appeal referring to the parish of St. Mary, Islington, was one in which the Water Board asked that the valuation should be reduced from £56,022 gross and £50,247 rateable to £43,788 gross and £34,613 rateable. In order to deal with this matter, Mr. Danckwerts had suggested to the Court that it was essential they should value, first of all, the whole of the amalgamated undertakings of the Water Companies in the hands of the Board, and should then apportion the total sum. The Board set forth in their case that certain deductions ought to be made; and the most important figure, after the gross receipts were arrived at, was the 28 per cent. of them for the rateable value, *plus* the rates, of the productive mains. Then they came to the Court, and said that the correct valuation would not show 28 per cent., but 21 per cent. They, however, admitted that the Court could not go below the figure in the notice of appeal; and therefore, upon their own showing, the hereditaments in question would have to be valued at a sum largely in excess of what the Board said their value was. It was necessary to remember that, in getting the value of the whole, the Board must be deemed to have taken the 21 per cent., which was the value of part; and if the total of the parts was really to equal the whole, they were in the position that if the Court put the places now concerned above their actual value, some other parishes would have to come below it. How was it possible for the Court, in this state of figures, to arrive at what they were told was the very thing the Court had to arrive at—namely, fixing such figures for the part that all of the parts would equal the whole? These parts must be put too high, according to the Board; and there was no getting out of it. These facts seemed to show the extreme difficulty of adopting the course which was put forward by the Board in these appeals as being the right one for the Court to take in order to arrive at the rateable value of the hereditaments. In support of the principle which he wished adopted, Mr. Danckwerts had two arguments. The first, of course, was that the Act of Parliament—the Water Act of 1902—constituted these undertakings one concern in the hands of the Board. If there was any foundation for this argument, there was no need for any other. Nothing could make them one undertaking better than the Act, if it had done so; and, under these circumstances, it was somewhat curious that it should have been thought necessary to rely upon another ground—namely, the actual fact of amalgamation in the hands of the Board. He challenged first of all this construction of the Act. If the Legislature had wanted to say that these undertakings in the hands of the Board were to be one, it could have been done in a single line; but the Act had not said so in express terms. The Act had, however, stated what was to be the effect of the transfer, in these words (section 3): "Subject to the provisions of this Act, as from the appointed day, the Water Board shall hold the undertaking of each Metropolitan Water Company, and may exercise all the rights, powers, authorities, and privileges of the Company, and shall (to the exclusion of the Company), be subject to all the duties, obligations, and liabilities of the Company, under the Acts, whether local or general, and the charters, orders, and other provisions relating to the Company, in like manner *mutatis mutandis* as if they were the Company." So that, with regard to each undertaking, the Board were to stand after the transfer in exactly the same position as the old Company. Was it a fair conclusion to draw from an Act so framed, and so express the conclusion that his learned friend asked the Court to draw from it—where the Act not only did not say that these undertakings were to be one concern in the hands of the Board, but went farther and said that the effect of the transfer was to be that each undertaking in the hands of the Board was to be in exactly the same position as it was in the hands of the Company. Mr. Danckwerts had relied upon the establishment of the water fund, and upon the fact that the whole of the receipts had to go to this fund; but the suggestion that a common fund for the receipts and payments of the Board made all these separate undertakings one concern, was surely very far-fetched. Take the Imperial Continental Gas Association, for instance, who had works in various large towns in Europe. The whole of their receipts were the property of one body of shareholders; but nobody in the world would say that for rating purposes each one of these gas undertakings was to be rated as part of the whole concern of the Company. He was not contending that the two cases were altogether analogous; but he did urge that the mere argument that because of the water fund these undertakings must be one concern was not one which should carry any weight. The second argument was that there had in point of fact been an amalgamation of the undertakings; but he doubted very much whether, if this could be proved up to the hilt, it would be a justification for saying that for rating purposes the Court would have to consider the matter. The case could not be dealt with as though it were an ordinary one, for it was admittedly unique; and where there was a long-established practice for rating purposes in connection with undertakings like this, the mere fact that they were grouped—not amalgamated, but grouped in one set of hands—because for the purposes of their own convenience they made certain alterations in the structure of the works and alterations in the modes of administration, could not be any reason for the Court, for rating purposes, to deem the undertakings to be one concern. The first suggestion, as he understood it, was that because the Board were taking certain water from the Thames for the purpose of supplying the New River district, this showed an alteration in the sources of supply, and created a difficulty in dealing with the case in any other way than that put forward. Long before the Board took over the undertaking, there was intercommunication, and water was supplied from the Thames, the Staines reservoirs, and elsewhere to the New River Company. This was all priced and charged for; and there was no difficulty whatever in rating the New River Company's district as a separate undertaking because of this. If it were wanted to do it now, it could be done. There was no difficulty in ascertaining the cost of water from the Thames, and apportioning it, if necessary; but the evidence of the witnesses, he contended, showed that there was no such necessity. So far as the actual supply went, there was ample in the New River sources; and so far as any water derived from the Thames was concerned, there should be no difficulty whatever in putting a price upon it. If the hypothetical tenant came and took this district, the question of the additional water from the Thames would not come in at all as far as he was concerned, because he would be satisfied with the fact that he had ample water for the requirements of the area, and that if water were brought in from the Thames it could only be as a matter of convenience for the purposes of people who owned, not only this particular district, but other districts too, and that if they brought water for their own convenience into the New River district they must be sending water from the New River district sources into other parts of their undertaking. Assuming for the moment that he was the hypothetical tenant, and wanted to rent some water undertaking in London, he might go into the New River district, and say to himself: "I cannot find the necessary capital to take the whole of the undertaking; is there a part I can have independently of the rest? I have got all I want in this particular area; and I will take it." There should be no difficulty whatever in fixing the rent he would be willing to give for it. The whole basis of the valuation put forward was that the Court had to find out the value of the whole; and to do this, they had to ascertain the value of all the unproductive works. Islington came forward with what they said was a rateable value of £50,000. The Board appealed, and said it ought to be £34,000; and they threatened if the appeal was not allowed to put in valuations made by eminent men to show that these unproductive works were worth £15,000,000. They said Islington would have no answer to this unless they chose to have all the works valued for themselves at enormous expense—an expense which, he thought, nobody would be willing to cast upon the ratepayers of any one of the parishes. Valuers never agreed; and were they, as the rating authority, to be told: "Accept our valuations, because they are made by eminent valuers, or go to the expense of having the whole of this property valued, at the cost of the ratepayers, for yourselves?" The only suggestion possible would be a combination between the parishes, in which they could all bear their share in having the unproductive works valued. Each parish valuing its own unproductive works had an interest in making them as high as possible; and any valuation made in this way would be equally open to criticism with the valuations which the Board had put before the Court. It was, if he might say

so, an oppressive thing that a rating authority should be placed in the position of having to accept the valuation of the other side or else incur a heavy expense in having valuations made for themselves. But this was not the only ground on which he urged that the principle put forward by the other side should not be adopted by the Court. This principle swept away from the Court altogether the benefit of the past history of these undertakings. The Court were asked to now put all this on one side. So what was the value of old assessments, and what was the value of what had been done in the past, whether by agreement or in Court? And in a case like Islington, where the history of the assessments of these very same hereditaments in the parish had been consistently progressive, where there had never been any difficulty with regard to the figures, the Court were asked at one swoop to make a reduction of £15,000—to say that in five years there had been a decrease in value to this extent. With regard to the occupier's share, was there any real reason why a departure should be made from the ordinary basis of taking the capital that a tenant would want? To say that the gross receipts could furnish any guide whatever to the capital the tenant would want or to the return he would expect upon it, was going quite wide of the mark. Mr. Ryde said the only reason he took the gross receipts was because he could not make enough of the occupier's share by taking the tenant's capital. This, however, was no reason for departing from an old-established practice. The main thing in Mr. Ryde's table was his 21 per cent. of the gross receipts. He did not think it possible that any figure put forward by a valuer could be left in a more unsatisfactory state than this figure was. If the Court wanted to take a figure, they had got to take the highest figure of the Water Board; and their highest valuation was, he maintained, 28 per cent., and not 21 per cent. It was absurd to say that Mr. Ryde put 33⅓ per cent. for safety on one of his valuations.

Mr. DANCKWERTS, in reply, said his learned friend had repeated again and again that the statement was untrue which Mr. Ryde gave to the Court, to the effect that he deliberately allowed a margin over his figure, which made it 28 per cent. Mr. Ryde did allow a margin, for two reasons—first, to secure himself against any chances of litigation; and, secondly, for the simple reason that he wanted to give the chance of arriving at an agreement with the other side, without the necessity for litigation, upon the figures which the appellants put forward. As to the Board requiring that the valuation of their engineers should be accepted, this was not the fact. They knew it would be a very expensive and long job to value these works, so they called in three engineers, who divided the work up between them; and their instructions were to value in such a manner that the other side could not, when they went into the matter, fail to agree to the figures—that was to say, to value them in an impartial manner, not putting it up as high as they could, but even paring down from what they thought it would probably be, so as to arrive at some figure which would be accepted by the other side. The case was adjourned for the respondents to check the valuations; but in six months they did nothing. They simply came back again, and said it would be so expensive that there was no use in their attempting it. As long as the principles and law of rating were what they were, inequalities must necessarily arise. In these large concerns, which spread over a number of parishes, there was always a difficulty, because they had to have a separate assessment in each parish, and because the Acts had laid down that, in order to arrive at the assessment in each parish, they must find the value of the whole, and then allocate it among the parishes. With regard to Islington, there were two points to which he must refer. First, there was the calculation by which Mr. Dewey sought to prove that the gross receipts which were given by Mr. Harris were incorrect. This turned upon a blunder which ought not to have been committed if Mr. Dewey had read the document upon which he professed to found his allegation. When the Board put before Parliament the gross revenue as the basis of the calculation which was then being made for some purpose or another in the Committee of the House, Mr. Dewey said they put forward gross receipts. He did not see that the document did not count gross value as being the same as gross receipts, because the document showed that the revenue given was the gross revenue—"no allowance being made for empty premises, bad debts, and losses in collection." With reference to his argument that the undertaking should be treated as a whole, he stood by this still. He was not going to repeat it; but it certainly was not the argument Mr. Morten said it was. It was simply that, according to law and according to fact, the concern was one. Now, there was no better established proposition of law as regarded rating than that, when they had to rate a thing, they must rate it as it was at the time. For instance, if they were going to rate premises that were used as a pigstye, they had to rate them for their value as a pigstye. The land might be ever so valuable, and the building might be ever so valuable from other points of view; but if it was used as a pigstye, they could not rate it upon its value for some other purpose. What the Court had to do, therefore, was to rate the Board's undertaking as it was used; and it was used as one concern. Another point which stood out clearly was that the Board must win, whatever happened, in the Islington case. The rating as it stood now was £50,000 odd; and if they took Mr. Fuller's own figures, these came out at £40,000 odd.

Mr. MORTEN: On the "one undertaking" basis. His other figures came out at £58,000.

Mr. DANCKWERTS replied that he knew that; but he was not arguing upon a basis which was not before the Court for the present purposes. He contended that the appeal must succeed whatever view was taken of the figures, because the respondents could not put the matter higher than their best witness thought he had proved. Of course, he knew they could not go below the figure which it was asked in the notice of appeal should be inserted—namely, £34,000 odd. He submitted some calculations based on Mr. Dinwiddy's evidence, which he said showed a percentage of 24·96, as against Mr. Ryde's 21 per cent., and the appeal figure of 28 per cent. Another basis, worked out on the principle of averaging the figures of the respondents' witnesses, gave 21·05 per cent., as compared with Mr. Ryde's 21 per cent., and the appeal figure of 28 per cent. If either of these calculations was correct, he said, the appeal must be allowed.

The CHAIRMAN intimated that a written judgment would be prepared; and the parties would be called together to hear it when ready.

Friday, Dec. 20.

The CHAIRMAN to-day delivered judgment in the following terms:—

THE JUDGMENT.

"The hearing of these appeals commenced on Dec. 14, 1906, and was from time to time adjourned. There were 137 appeals in all set down for trial; but there were only six respondents with whom the Metropolitan Water Board had not come to terms—City of London Union, 101 parishes; Greenwich Union, three parishes; Woolwich Union, three parishes; Holborn Union, six parishes; Borough of Islington; and Borough of St. Pancras. Of these, only four were heard *in extenso*. The assessments appealed against in the four cases heard were: City of London Union, £81,237 gross, £54,098 rateable value. Greenwich Union: Parish of St. Paul, Deptford, £19,000 gross, £15,000 rateable; Parish of Greenwich, £10,133 gross, £8435 rateable; Parish of St. Nicholas, Deptford, £2004 gross, £1670 rateable. Woolwich Union: Plumstead, £8060 gross, £6717 rateable; Parish of Woolwich, £5771 gross, £4810 rateable; Charlton and Kidbrooke, £3785 gross, £3154 rateable. Borough of Islington, £56,022 gross, £50,247 rateable. Holborn and St. Pancras stand over for settlement after the figures have been delivered in the appeals above mentioned. The printed cases filed by the appellants and respondents in these appeals sufficiently set out the constitution of the Metropolitan Water Board and the contentions of the various parties, and make it unnecessary for us to deal with them at any length. In our opinion, the undertaking of the Board is one undertaking, and must be valued as a whole. We think that the method of valuation relied on by the appellants is the right one—namely, the profit-bearing method. We have taken as the basis of our valuation of the whole undertaking the total gross receipts at £2,761,974. We have not been able to accept the appellants' figures as a whole, especially those in regard to amounts to be deducted for working expenses, occupier's share, &c.; and we have come to the conclusion that the total rateable value, *plus* rates, of the directly productive mains of the whole undertaking is £783,888—that is, 29·57 per cent. of the total water receipts, £2,651,209. We have ascertained the rateable value, *plus* rates, of the productive mains in each parish by taking this percentage of the gross water receipts in each parish; and, after deducting the rate actually paid in each parish except in the City of London, have added the rateable value of the indirectly productive mains, works, and other hereditaments in the parish, thus arriving at the total rateable value in each parish. We feel that none of the respondents in the appeals have put before us any other practicable method of valuation. We are of opinion, on the evidence adduced, that it is impossible to ascertain what are the expenses in any particular parish apart from the whole, except by hypothetical calculations based upon no accurate facts. Having regard to the fact that the position was a new one, that important principles were involved, and that widely divergent figures were put forward by all parties (representing as they do public bodies), and the fact that our figures are somewhat, though not much, in excess of the claim of the appellants, we consider that it is, in the circumstances, only right and proper that the respective parties in these appeals should bear their own costs. Rateable values as fixed by the Court: City of London Union (101 parishes), £33,798. Borough of Islington, £38,058. Borough of St. Pancras, £24,296. Greenwich Union—Parish of St. Paul, Deptford, £14,506; Parish of Greenwich, £7290; Parish of St. Nicholas, Deptford, £1276. Woolwich Union—Parish of Plumstead, £5496; Parish of Woolwich, £4617; Parish of Charlton and Kidbrooke, £2613.

Subsequently, the CHAIRMAN consented, on the application of Mr. BALFOUR BROWNE, to state a case for the High Court on the question of the principle of valuation that had been adopted by the Court.

Failure of a Promoter of the Kent County Gas Company.

At the London Bankruptcy Court, on the 21st ult., a sitting was held before Mr. Registrar Hope for the public examination of Henry Warwick Gyde, described as a financier, of No. 21, Great Winchester Street, E.C. The debtor, it may be remembered, was concerned with the promotion of the Kent County and West Suburban Gas Companies; and his statement of affairs showed liabilities £256, and assets £10,000 in unquoted shares, the value of which was unknown. At the date of the receiving order, he was carrying on business in partnership with another person under the style of Walter Darby and Co. On the case being called on, Mr. G. W. Chapman, the Official Receiver, said the statement of the debtor's affairs had been filed too recently to allow of his being examined upon it, and he asked for an adjournment for a month, which was granted. The matter came up again last Thursday; but Mr. Chapman reported that the debtor was stated to be suffering from an old attack of sciatica, and was unable to attend. All parties consenting, the Registrar adjourned the sitting till the 16th prox.

Curious Compensation Case at Sunderland.

At the Sunderland County Court, last Wednesday, Edwin Cogdon claimed compensation, under the Act of 1906, from the Sunderland Gas Company in respect to an accident which occurred to him while engaged by them as a workman. The plaintiff, Mr. Jacks explained, was a labourer; and on Aug. 26 he was sent to dig a trench. While he was busy, he wished to go to a place of convenience. He obtained the permission of his foreman to do so; and as his father-in-law lived not far away, he went to his house for the purpose. He opened the house door; and in going into a room placed a foot where the floor was broken and there was a hole. As a result, he fell; and one of his ankles was broken. The reply of the respondents to the application was that the injury was not caused in the course of the man's employment; and the accident did not occur on premises over which they had control or management, and while he was engaged in his work. His Honour Judge O'Connor remarked that it was for Mr. Jacks to show how the accident arose out of, and in course of, the man's employment. Mr. Jacks said his contention was that the new Act covered such an occasion; that there was really no interruption in the man's work; that he was doing what was necessary; and that he went to the nearest

and most convenient place. His Honour: Supposing a man goes to dinner and chokes himself? Mr. Jacks said that would be different, because there would be a definite interruption in the work, which the man had left. In the present case, however, he could not be said to have really left his work. His Honour pointed out that applicant had gone to a place that was not in the control of the respondents, and was of his own choice, and asked: "Are you going to make the employer responsible for any trap in the whole parish?" Mr. Jacks argued that it was in this case a question of necessity; and this was the handiest place. Mr. Taylor (for the Gas Company) said the house where the accident happened was 250 yards away from the place where the man had been working. Without hearing the defence, His Honour said when the applicant left the sphere of his employment, wandered at his own will, for his own operations, went on private property, and was injured by a fault in private property, he really could not hold the employers responsible. Judgment was given for the respondents, with costs.

Claim for Disturbance by a Gas-Engine.

At Rotherham County Court, on the 11th inst., before his Honour Judge Denham Benson, Hannah Broadbent, a widow, of Pitt Street, Holmes, took proceedings to restrain Messrs. George Shaw and Sons, of the Holmes Pottery, from working a certain gas-engine on their premises in such a manner as to be a nuisance to the occupiers of her property, and to recover £10 damages in respect thereof. Mr. Horace Wilson, who appeared for the complainant, said in March last the defendants began to work a gas-engine of 150 H.P., and the result was a frequent series of explosions which were compared to the firing of a 6-inch gun. Frequent interviews had taken place between the plaintiff's solicitor and the defendants; and he (Mr. Wilson) presumed that every possible effort had been made to put an end to the nuisance. But supposing the defendants had done all they could to mitigate it, it was no excuse to say they could not help it and were using the engine in a reasonable way. Another complaint was of the vapours and fumes arising from charcoal burning, chiefly on Sundays. Plaintiff and several witnesses having given evidence as to the nuisance and the damage to the houses in the vicinity of the pottery, Mr. T. E. Ellison, for the defendants, argued that it was physically impossible for the explosions of the engine in question to cause the damage described by plaintiff's witnesses at the distance away the property was situated. The engine was a fairly large one, and it occasionally, as did other gas-engines, missed fire, which led to an explosion. It was absolutely without any foundation to say that there had been any damage done. Mr. T. Shaw, the managing partner of the firm, stated that the engine was one of the most improved type. He had never known a gas-engine that would not occasionally fire-back and create a noise; but it would be impossible for such explosions to do damage to surrounding property. The engine was usually run from 6 a.m. to 6 p.m., and the largest number of explosions that occurred on any one day was the 2nd of December, when it was being adjusted. It then exploded sixteen times, and the noise was more like that of a shot gun than anything else. During the past few days a new silencer had been fixed, to reduce the noise and the liability to fire-back. Other witnesses for the defence having been called, considerable legal argument ensued, and his Honour reserved judgment, which was delivered on Friday. He said, having regard to the locality and the nature of the trades carried on there, and to the noise existing prior to the introduction of the gas-engine, there was no sufficiently serious and additional disturbance of the plaintiff's tenants to justify him in coming to the conclusion that her reversionary interest had been damaged, or that he ought to grant an injunction. As to the alleged nuisance from the smoke of charcoal burning, he did not find that it was proved. There must, therefore, be judgment for the defendants. In view, however, of the fact that the appliance to modify the temporary disturbance caused by the engine was not introduced until after the action had been brought, his judgment would be without costs.

Dunmow Water Supply.—Boring for water has just been completed at Dunmow on behalf of the Mid-Essex Water Company, who have undertaken to supply the town. The borehole has been sunk to a depth of 302 feet; the final 119 feet being through chalk. The water level has risen to within 32 feet of the surface, and a pumping test showed at least 6500 gallons an hour to be available.

St. Pancras Borough Council and Meter-Rents.—At the meeting of the St. Pancras Borough Council last Wednesday, the Parliamentary and General Purposes Committee submitted a long report with regard to the reimposition of meter-rents by the Gaslight and Coke Company. They had received letters from the Islington and Finsbury Borough Councils indicating the steps they had taken with the view of obtaining a Government inquiry into the management of the Company, and an explanatory statement in regard to the subject. They reviewed what had been done by the London County Council in the matter, and set forth the reasons for the Council not objecting to the Company's proposals; and they concluded by recommending that no further action should be taken, and that the two Borough Councils named should be informed accordingly. The recommendation was agreed to.

Destroying Gas-Pipes in Glasgow.—In the Glasgow Sheriff Criminal Court on Thursday last, before Sheriff-Substitute Davidson, a young man named James Marshall was brought up on a charge of malicious mischief in cutting the gas supply pipes on common stairs in Fraser Street and London Road. He pleaded guilty, and gave, as an excuse for his actions, that at the time he was out of work. The Sheriff said the damage done was very slight compared with the extreme danger which the conduct of the accused might have entailed on a great number of people. It was prefectly obvious, and must have been known to the accused, that if there had been an ignition of the gas in any of the places named, it might have caused the death of a number of people against whom he had no grudge. It was very fortunate for the accused that no accident happened. The sentence would be one of three months' imprisonment.

MISCELLANEOUS NEWS.

STRIKE AT THE DUBLIN GAS-WORKS.

In the "JOURNAL" last week (p. 868), reference was made to a dispute which had arisen between the Directors of the Alliance and Dublin Gas Company and some of the workmen, which threatened to result in a strike. Unfortunately, this eventuality was not averted; and some of the yardmen and retort men left their work on Friday. The dispute has been in progress for about a month. According to a statement made by Mr. George Greig, the official delegate of the National Amalgamated Union of Labour, he wrote to the Directors of the Company on the 29th of November making the following demands: "(1) That the extra work put on the retort men in April, 1907, be taken off. (2) That the wages of the men employed as purifiers be advanced to 25s. per week of 54 hours, and overtime to be paid for at the rate of time-and-a-quarter. (3) That the yardmen's wages be advanced to 20s. per week of 54 hours, and all overtime paid for at time-and-a-quarter. (4) That the wages of pipe-jumpers be advanced to 4s. per shift. (5) That the hours of lift men be reduced from twelve to eight per day, the rate of wages to remain at 27s. per week. (6) That the hours of boilermen and their helpers be reduced from twelve to eight per day, the rate of wages to remain at 30s. per week for boilermen and 23s. for boilermen's helpers." To these demands a reply was received from Mr. F. T. Cotton, the Secretary and Manager of the Company, refusing to recognize any outside interference, and declining to continue correspondence with Mr. Greig. On the 14th inst., Mr. Greig wrote to Mr. Cotton, offering, on behalf of the men, to have the matters in question submitted to arbitration. To this communication no reply was sent. Thereupon Mr. Greig advised the men to send a deputation to the Directors. This was done last Thursday, and they put forward demands similar to those contained in the delegate's letter of the 29th ult. The Directors promised to take the matter into consideration and send a reply; and it was issued on Friday. They said that, bearing in mind the existing state of the labour market, and the number of unemployed in the city of Dublin, they saw no justification for the men's demands, and therefore regretted their inability to comply with them. When the nature of the reply, which was posted up in the works, was seen, the men left their work without holding any formal meeting, as was intended, to determine on a strike. According to a statement made by the Chief Engineer (Mr. W. F. Cotton, jun.) to one of the representatives of the "Freeman's Journal," the men's action will not seriously embarrass the Company.

CO-PARTNERSHIP—"THE WAY OF PEACE."

The first article in the current number of the "Co-Partnership Journal" of the South Metropolitan Gas Company is by Sir George Livesey, who gives it the title quoted above, and devotes it, at the suggestion of the Editor, to the subject by which the title is preceded, and which, as all the world knows, is so much at the writer's heart. A few extracts from the article may not be unwelcome to those who still associate peace with the present season, and share Sir George's views as to the desirability of securing it in the industrial world.

There is great evil in the industrial world in all Christian lands. Wars and rumours of wars between Capital and Labour are almost everywhere and in all trades; and where there happens at the time to be no actual war, it is generally an armed peace, which is a peace due to fear, and therefore not a true peace. To keep the peace in labour disputes, soldiers are often required in this and other lands; and bloodshed may result, as was the case in Belfast a few months ago. A few weeks later a small strike took place at Armstrong's, in the shipbuilding trade, contrary to the agreement, and the Shipbuilders' Federation gave notices for a general lock-out. Then the Railway Mens' Union balloted in favour of a strike, which alarmed the public. The Government induced both parties to agree to the formation of Conciliation Boards and arbitration; but if all I hear and read be true, the spirit of antagonism still exists.

No sooner is the railway dispute settled than notices are given for a great strike in the cotton trade. The Board of Trade, with much difficulty, again prevented a strike, and within a few days another dispute in the same town—Oldham—arose with another class of workers in the same trade. There was a report of some correspondence in "The Times" of Dec. 11 between the two Committees, and bitterness could be read in every line. In the engineering trade very powerful organizations are maintained on both sides, resulting in an armed peace. I have often asked master builders how they are getting on with their men. The answer has generally been, "Very badly," or, "As bad as can be." In the gas industry all over the kingdom machinery and other means of saving labour have been introduced; and I have made it my business to ask what was the chief reason, and have repeatedly got the reply that the main object was to dispense with labour—"anything, whatever it costs, to get rid of men." Mr. Carpenter has recently been on the Continent to inspect vertical retorts, and has been told that they are introduced to save labour, because it is so difficult to deal with. It is the same in America and in every European nation; and in Australia and New Zealand Capital and Labour are almost everywhere antagonistic.

Enough, however, about the evil in the industrial world, for everybody is convinced that it exists. Is there a remedy? "If there is one, try and find it." There is a remedy. It has been found in the great principle of what is now called "co-partnership"—the "co" means equal or full and complete partnership. It has proved successful in various trades, while in the gas industry our Company have had eighteen years' practical experience, the South Suburban Gas Company fourteen

years', the Commercial Gas Company six-and-a-half years', and Chester and Newport about six years' each, or in all fifty years, of co-partnership. I can speak for several of the Companies from personal knowledge; and I believe all can say that they are entire strangers to the evils referred to above, or to other difficulties in the relations of employers and employed; and not only has evil ceased, but good has taken its place, as the result of co-partnership.

It may be said that eighteen years in one Company, or the aggregate experience of fifty years, is not sufficient to prove the truth of my statement that we have found the remedy. How else during such a time of unrest in the Labour world during those years can the peaceful conditions in these co-partnership Companies be explained? But more can be said. It is a fact that every year that has passed has been better than the last. As their holding of stock increases, the employees become more and more interested in, and attached to, the Company. They have become owners of property by the help of the Company; and in most cases their all is invested in it. It is true their eggs are in one basket, but the basket is their own; and, after all, I would rather have my eggs in my own basket than put them into that of a stranger. Moreover, co-partnership has provided both the eggs and the basket. The feeling of friendship and goodwill grows stronger year by year—a very strong proof that co-partnership is the true remedy for the ills mentioned above.

What has co-partnership done in this Company? Suppose eighteen years ago, when it was started in storm and stress, some prophet had foretold that in 1907 all the regular employees of the Company, to the number of over 5000, would be shareholders, with some £350,000 in the Company. There was not a man in existence at that time who would have believed such a prophet. Suppose he had said that in 1907 there would be three employees on the Board—two workmen from 1897 and one clerk from 1901—elected by the employee shareholders, and that they would choose the best men they could find, and would re-elect the same men year by year; that these Employee Directors would take their part intelligently, faithfully, and loyally with the other Directors in the responsible management of the Company; and that shareholders, Directors, officers, and workmen would be perfectly satisfied with this crown or topstone of co-partnership. Again the prophet would not have been believed.

Suppose the prophet had said that the bonus would amount in 1907 to £45,590, and that out of this large sum £42,600 would be invested in the Company's stock—half under the rules, but the other half voluntarily. Would such a prophecy have been believed? Suppose he had said to me in 1889: "You have been connected with this Company over forty years; you have known the men intimately, especially in your early days; you have often said that a very friendly feeling existed, but that as the years passed it had grown weaker, and that you felt out of touch with the workmen." To all this I should have agreed. If he had then said that eighteen years hence the old friendly feeling would be more than restored, and that the relations of the workmen with the officers and foremen would in 1907 be of the most friendly character, and that all officers, foremen, and the great majority of workmen would work heartily together for the general good, would not the reply have been that all the signs of the times were in the other direction (as they are still), and that such a "good time coming" could not be thought of as possible? Mazzini prophesied seventy years ago that partnership would be the remedy; and this we have found true.

Have I said too much or put it too strongly? I reply, No, so far as the possibilities of co-partnership are concerned, if we, employers and employed, work it rightly. If co-partnership is carried out in its true spirit—employers and employed heartily co-operating to do what is just, and right, and kind, and considerate—all, and even more than all, that the supposed prophet foretold is quite reasonably possible; and nothing else or other than true co-partnership will do it. It will be said to me, "You are putting it in the place of Christianity." I dare not, and will not, do that; but my reply is that co-partnership is Christianity in business. . . . Do as you would be done by, and love your neighbour as yourself—that is co-partnership in the highest and best sense. Who will say that the golden rule is not applicable to all the affairs and business of life, and who does not believe that if we all acted upon it, the world would be infinitely better and the business and industrial world would be peaceful, happy, and prosperous? It is only by co-partnership, in its true and best sense, that this can be hoped for; but it can only come by human effort. The standard is very high, but we can at least try for it; and if we try in the right spirit, we shall surpass our faint-hearted or even our most sanguine expectations.

Readers will probably compare the above high standard of co-partnership with the practical results. I can only say for myself and others that, with much imperfection, we have tried to act up to it; though, speaking for myself, I feel I have often fallen short. But I am sure the principles here advocated are right; and I have no hesitation in asking all co-partners, both employers and employed, to try to act up to them. It is the duty of the employer to deal justly towards his workmen; and it is equally their duty to do the same towards their employer, or there can be no true Co-Partnership. . . . If the rank-and-file believe in it and do their duty, the future is safe. If we all try our best to act on the great principles above stated, which are the foundation of co-partnership, there is no doubt that the remedy we have found will be permanently successful.

GAS AFFAIRS AT NEWRY.

Two Years' Accounts.—Urging Men to Strike.

At the last Meeting of the Newry Urban District Council, the Gas Committee reported that the audit of the gas-works accounts for the years ending March 31, 1906 and 1907, had been completed, with the Auditor's report thereon; and certified abstracts having been received from the Local Government Board, it became the duty of the Committee to submit to the Council their report for the same period. The total revenue receipts for the year ended 1906 amounted to £8843, and the expenditure, which included principal and interest on the loan, to £8450. In 1907 the receipts amounted to £8429, and the expenditure to £8180. At the close of the financial year 1906, there was due by the Treasurer £392, and at close of 1907 there was a credit balance of £249. The net profit for the year 1906 amounted to £347, and for 1907 there was a net profit of £294. The instalment of loan repaid for the year ending 1906 showed a sum of £6669, and for the year 1907 £7268; and there was due to the mortgagees a sum of £24,731. The old retort-house had been completely renewed with settings of retorts on the regenerative principle; and so far they had been working satisfactorily. These renewals would, it was stated, add

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 895.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
268,324	10	,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Oct. 30	7	Bombay, Ltd., . . .	6¾—6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½—5	..	5 12 0
50,000	10	Aug. 29	14	Bourne- mouth Gas and Water } 10 p.c. . .	27½—28½	..	4 18 3
51,810	10	,,	7	B 7 p.c. .	16½—17	..	4 2 4
53,200	10	,,	6	Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	243—248	..	5 0 10
300,000	,,	,,	9½	Do. New . . .	181—186	+1	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref. .	115—120	..	4 3 4
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	98—101*	..	3 19 3
220,000	Stk.	Sept. 27	11½	Brighton & Hove Orig.	200—210	..	5 7 1
246,320	,,	,,	8½	Do. A. Ord. Stk. .	153—158	..	5 4 5
460,000	20	,,	10	British	40—41	+½	4 17 7
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c. .	117—120	+1	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .	87—90	..	5 0 0
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	10¾—11¼	..	6 4 5
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb. .	89—91*	..	4 7 11
150,000	20	July 12	8½	Cagliari, Ltd.	26—27	..	6 2 3
100,000	10	—	—	Cape Town & Dis., Ltd.	6—8	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref. . .	7—9	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
100,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord. .	108—110	..	4 10 11
1,443,280	Stk.	,, 29	5⅛	Commercial 4 p.c Stk. .	100—105	..	4 19 0
560,000	,,	,	5	Do. 3½ p.c. do. .	98—103	..	4 17 1
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	80—82*	..	3 13 2
800,000	Stk.	,,	6½	Continental Union, Ltd.	106—111*	..	5 17 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—140*	..	5 0 0
460,170	Stk.	—	5½	Derby Con. Stk. . .	122—123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk. . . .	103—105	..	3 16 2
486,090	10	July 31	12	European, Ltd. . . .	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	16½—17½	..	5 2 10
15,182,590	Stk.	Aug. 15	4 1/16	Gas- light and Coke } 4 p.c. Ord. . . .	94—96	..	4 11 7
2,600,000	,,	,,	3⅜	3⅜ p.c. max. . .	86—88	..	3 19 7
3,799,735	,,	,,	4	4 p.c. Con. Pref.	101—104	..	3 16 11
4,193,975	,,	Dec. 13	3	3 p.c. Con. Deb.	81—83*	+1	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—95	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117	..	5 11 1
70,000	10	Oct 11	8	Hongkong & China, Ltd.	19—20	..	5 10 0
4,940,000	Stk.	Nov. 14	8	Imperial Continental .	163—170	+½	4 14 2
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c. .	110—120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A . .	220—222	..	4 10 1
718,100	,,	,,	7	Do. B. .	158—160	..	4 7 6
152,736	Stk.	Feb. 14	7⅛	Maidstone 5 p.c. . .	140—145	..	5 5 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb..	99—101	..	4 19 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 14	3½	Monte Video, Ltd. . .	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	105—107	—½	4 6 5
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	88—90	..	3 17 9
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Nov. 28	8	Oriental, Ltd, . . .	135—138	..	5 15 11
60,000	5	Sept. 13	7	Ottoman, Ltd. . . .	6—6⅛	..	5 7 8
398,490	5	Oct. 30	7	Primitiva Ord. . . .	6½—7	+¼	5 0 0
796,980	5	July 31	5	Do. 5 p.c. Pref. .	4¾—5⅛	..	4 17 7
488,900	100	Dec. 2	4	Do. 4 p.c. Deb. .	92—94	..	4 5 1
1,000,000	10	Oct. 11	8	River Plate Ord. . . .	12¾—13½	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb. .	92—94	..	4 5 1
250,000	10	Sept. 27	8	San Paulo, Ltd. . . .	13—13½	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb. .	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	243—245	..	4 1 8
209,984	,,	,,	10	Do. B	243—245	..	4 1 8
523,500	,,	,,	10	Do. C	243—245	..	4 1 8
70,000	10	Nov. 14	10	South African	14½—15½	..	6 9 0
6,429,895	Stk.	Aug. 15	5⅜	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155—157	..	5 1 11
605,000	Stk.	Aug. 15	5⅜	S'th Suburb'n Ord. 5 p.c.	114—117	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	117— 20	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord. . .	104—109	..	4 11 9
120,000	Stk.	Aug. 15	6⅜	Tottenham and Edmonton } A 5 p.c. .	120—123	..	5 9 9
398,940	,,	,,	5¼	B 3½ p.c. .	100—103	..	5 1 11
149,470	,,	Dec. 13	4	4 p.c. Deb.	97—100*	..	4 0 0
182,380	10	June 13	8	Tuscan, Ltd.	10⅜—11	..	7 5 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 18 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- worth and Putney } A 5 p.c. . .	—	..	—
255,636	,,	Aug. 15	6½	B 3½ p.c. . .	128—133	.	4 17 9
75,000	,,	,,	5⅝	C 3½ p.c. . .	—	..	—
80,075	,,	June 27	3	3 p.c. Deb. Stk	75—80	..	3 15 0
845,872	,,	Aug. 15	5⅜	West Ham 5 p.c. Ord. .	100—103	..	4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref. . .	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	101—104	..	3 16 11

Prices marked * are "Ex div."

materially to the productive power of the works. The total outlay in connection with the renewals was upwards of £900; and it had all been paid out of revenue. As the matter was referred to in the Auditor's report, the Committee mentioned that they had arranged to adopt the Public Bodies Order in keeping their accounts in future. With the exception of the station meter, the works generally had been maintained in good repair.

The Auditor (Dr. Ellis), in his reports to the Local Government Board on his audit of the accounts for the two years, stated that the abstracts which were duly certified by him followed the lines of those certified at previous audits; the Local Government Board having instructed him to audit the accounts in their present shape without requiring compliance with the Public Bodies Order. In the course of his report, Dr. Ellis said: "It came under my notice that there is a balance standing in the Treasurer's books to the credit of the Committee in respect of interest which has accrued upon balances remaining in his hands. This interest should be at once transferred to the credit of the ordinary account, and all interest accruing to credit in future should be at once placed to credit on the same account. At a meeting held on June 15, 1906, the Gas Manager (Mr. Brooke Gibson) was granted three days leave of absence to attend a meeting of gas managers to be held in London; and a sum of £5 was granted to him for the expenses of the trip. As I could find no statutory or other lawful authority for such a grant out of the public funds, the amount has been surcharged to the members of the Committee who authorized the grant."

The Chairman of the Gas Committee (Mr. Thos. P. Ledlie) referred to the statement in the report that upwards of £900 had been spent on the works out of revenue; and he said that, as a consequence, they had obtained better results from the coal carbonized and from the coke. Unfortuately, the price of coal had gone up, and this year an extra payment of between £900 and £1000 would have to be made; so that a further reduction in the price of gas was out of the question for the present. Indeed, if they could tide over the extra payment without increasing the price, they would be well satisfied. The last reduction they made—5d. per 1000 cubic feet—meant £633 less revenue every year; but he believed that, with careful supervision, they would be able to carry on the works without putting anything on the price of gas. The officials were most attentive to their duties, and consequently the condition of the works was very satisfactory. He moved the adoption of the reports; and the motion was carried unanimously.

The strike of dockers in Newry reached an acute stage on the 10th inst., when the gas-works were invaded by the representatives of the men on strike. According to the "Newry Reporter," the majority of the men in the gas-works have joined the Dockers' Union—only two or three remaining non-Union men. In the afternoon of the above-named day, Mr. Fearon, the local Secretary of the Union, with seven other men, appeared at the works, and told the Manager that he had come to give him verbal notice that the men employed there belonging to the Union would cease work in a week. Mr. Gibson said he could not accept verbal notice from him, and informed him that the time to give notice was on Friday evening after the men had received their wages; but if he considered he was entitled to give any notice, he would take a written notice and submit it to the Gas Committee of the District Council. Fearon then left, and returned at half-past five as the new shift were going on. It is said that he tried to persuade the men not to go on duty; but they, evidently alive to the consequences, refused to obey. He then entered the yard, where he was met by Mr. Gibson, who drew his attention to the notice-board prohibiting anyone except those having business there from being on the premises. Fearon said he wished to address the men on the premises; but Mr. Gibson told him he could not permit him to do so, and ordered him to leave. Fearon then went out, mounted a wall, and proceeded to address a number of men, some few of whom are employed in the works, and were about to go on night duty. He pointed out that they were not getting enough pay—that the stokers must be paid at least 30s. per week; and he wound up by going into the office and verbally giving notice on the men's behalf that they must cease work in a week's time. The police heard of the affair, and a sergeant arrived on the scene in time to witness Fearon's departure after the meeting. The men whose wages were specifically referred to were the stokers; but, of course, the labourers would also be thrown out of employment. Each shift consists of four men—a leading stoker and three assistants. The leading stoker gets 27s. per week, and the assistants 23s. per week. The other workmen embrace two fitters, each of whom is paid £1 per week; three lamplighters, who get 17s. per week each; and five or six labourers, who are each in receipt of 15s. per week. No complaint whatever was made by the men prior to Fearon's visit or after it; and no notice was given by any of the men of their intention to leave. The men are required to give a week's notice on pay day, either verbally man by man as they are being paid, or by a written notice signed by each man. If the men had gone out, they would have rendered themselves liable, under the Conspiracy and Protection of Property Act, to a fine of £20, or three months' imprisonment, for breaking their contract with the Gas Committee.

EXPLOSION AT THE WOMBWELL GAS-WORKS.

Two Workmen Fatally Injured.

Between two and three o'clock in the afternoon of the 11th inst., an explosion, followed by a fire, occurred in the old exhauster-house at the gas-works of the Wombwell Urban District Council during the refixing of the flap of a bye-pass valve, with the result that three men—James Lister, the foreman, Arthur Burrows, the chief stoker, and Harry Schofield, a retort-setter—were severely burnt and the building was set on fire. The injured men were removed to the Beckett Hospital, Barnsley, and the fire was extinguished by the workmen, who had a good supply of water, before the arrival of the fire brigade. Fortunately, the damage was confined to the exhauster-house. On arriving

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at the hospital, Lister's condition was found to be serious; and he succumbed to his injuries on the following Friday. Schofield, who appeared to be making good progress towards recovery, became worse on Wednesday, and died early next morning. An inquest was opened on Lister on Monday last week, in the Barnsley Town Hall, by Mr. Maitland. Frederick Lister, son of the deceased, stated that when the ignition of gas took place his father stayed to turn off the valve of the bye-pass, and by breaking the glass in the window with his fist attempted to escape. He then went to another part of the yard, and turned off other valves. Going in the direction of the retort-house, he shouted to the stokers to "strike all the lids—sharp." During the whole of this time his clothes were on fire, and one of the men wrapped his coat round him and put out the flames. Dr. Mercer, the House Surgeon at the Beckett Hospital, said that deceased was badly burned about the face, neck, arms, and back and one hand was bleeding severely as if cut with broken glass. The cause of death was blood poisoning as the result of burns. The inquest was adjourned for a month.

ELECTRIC STREET LIGHTING AT TUNBRIDGE WELLS.

A Pause in Extravagance.

Some facts worth pondering over are set forth in an article contributed to the "Kent and Sussex Courier," by a member of the Ratepayers' League, on the "Cost of Street Lighting" at Tunbridge Wells. After pointing out that the annual cost of street lighting has risen from £2710 in 1895 to £4650 in 1907, the writer remarks that the Corporation have at last realized the seriousness of this expenditure by deferring till their next meeting a proposal by the Lighting Committee to further extend the electric street lighting. Among his subsequent remarks are the following:

The increase in cost of lighting, calculated at the present price of gas, would represent nearly 24 miles of new streets, which have certainly not been added to the borough. Neither is the increase to be attributed to the cost of gas, which has been reduced by 7d. per 1000 cubic feet in price, and the street gas lighting has benefited in proportion by the reduction. The source of the increase must, therefore, be sought in the fact that the Municipal Electricity Committee, having taken over from the Watch Committee the control of public lighting, have been in the invidious position of both buyers and sellers, and have created a monopoly in which they have charged the ratepayers higher prices than they would have been able to secure in open competition with the Gas Company. Assuming that the Watch Committee once more exercised their proper control as guardians of the public purse, what would be the position of affairs for their consideration? We will first deal with the ordinary street lighting, as it will, of course, be stated that one cause of this increase of £1900 per annum is the greater illumination by the arc lamps. Comparing the cost of the municipal glow lamps with incandescent gas, we will give the cost per mile for the sake of simplicity. The incandescent gas-lamps in Tunbridge Wells work out at £83 per mile, and the present cost of the electric glow lamps at £115 per mile. The illumination of the electric glow-lamps is, however, much inferior to the 60 or 70 candle power incandescent gas-lamps, so that the result of municipal trading in this respect is not only increased cost, but a return to the dimly-lighted streets of the old days of flat-flame gas-burners. The Electricity Committee now propose to lower their charges to those of the Gas Company, on condition that 200 more gas-lamps are transferred to the electric mains. This would represent the future cost of electric glow lamps at £100 per mile at present distances, as against the existing cost of incandescent gas at £83 per mile. Assuming that the Watch Committee made the same offer to the Gas Company that the Electricity Committee make on their own behalf, it may be taken that the Gas Company would offer a further reduction in price. It is obvious, therefore, if the Watch Committee were dealing with the street lighting solely in the ratepayers' interest, that they would tell the Electricity Committee that their offer is not good enough; and as the Electricity Committee's accounts showed a net profit last year of £1455, and took from the ratepayers £1300 more for street lighting than gas lighting would have cost, there is no doubt that the Electricity Committee would make the Watch Committee a better offer than that which they now make in their privileged dual capacity of buyers and sellers. It should be explained that these figures do not bear out the statement at the Council that the cost of the electric light would be reduced to that of gas-light. Nominally this is so; but as the electric lamps are placed about 60 yards apart, and the gas-lamps 75 yards apart, it is evident that the electric lamps would be more numerous than the gas-lamps displaced. A similar experience in Tunbridge Wells may be anticipated to that of St. Pancras, where the municipal undertaking reduced the charge per lamp, but adjusted matters by erecting additional street-lamps, and secured £1460 more income than in the preceding year. Another point for the consideration of the Watch Committee would be the experience of Canterbury, where, though the price of gas is the same as at Tunbridge Wells, the street gas-lamps cost £4 instead of £3 9s. 4d. in Tunbridge Wells. This is because Canterbury, owning its electricity undertaking, took over the street lighting, leaving the Gas Company only outlying districts, where it would not pay them to lay electric cables. This is what is now proposed in Tunbridge Wells; and if we may follow the analogy of Canterbury, the Gas Company will presumably increase their charges for the lamps left to them in districts where electricity cannot be substituted except at a large capital outlay, and thus recoup themselves for loss of revenue, as it will then be in their hands to charge just what they please, with the result that the Electricity Committee's proposed reduction in price will still further be more apparent than real.

Some more explanation must, however, be sought of the fact that the ratepayers are paying an increase of £1940 per annum in the cost of street lighting. The expenditure for gas and electricity for public lighting last year was £4650. Taking the cost of gas lighting at its present price, and making an estimated allowance for the extended

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LEST YE FORGET.

area to be lighted since 1895, the total cost of public lighting by gas alone last year may be estimated at £3400. This shows, as the result of municipal trading, a loss of £1250 per annum to the ratepayers on street lighting.

On the other hand, the Gas Company, by the reduction of 4d. they have made in the price of gas during the last three years, are now benefiting the consumers to the extent of £4000 per year, and the street lighting has benefited in proportion. The municipal undertaking has contributed nothing to the relief of the rates since 1900, but is taking from the rates £1300 a year in excess of what would be the cost of street lighting by incandescent gas. A reduction in the price of gas is of as much benefit to the ratepayers as a reduction in the rates, as practically every household uses gas. The Gas Company probably contribute from £900 to £1000 annually to the rates; so that the revenue of the Company is of even greater importance to the ratepayers than the revenue of the electricity undertaking.

We now come to the street arc lighting, which works out at an average of £390 per mile, as against £83 per mile for incandescent gas; or, assuming that the gas-lamps were doubled in number in the main thoroughfares, an effective illumination could be obtained for £166 per mile, as against £390 per mile for arc lamps. In our main thoroughfare, however, the cost of arc lighting works out at much higher than this. In one part, the cost is at the rate of £600 per mile per annum; and the arc lamps are, moreover, extinguished at about eleven o'clock. In another part, the arc lamps work out at a cost of £495 per mile; and Mount Ephraim costs £210 per annum for ten arc lamps, as against £70 if twenty incandescent gas-lamps were to be substituted.

VOTING POWERS FOR PUBLIC COMPANIES.

Action by the City Corporation.

The Corporation of the City of London have decided to approach the President of the Local Government Board with a view to the introduction by the Government of a Bill to place representatives of limited liability companies on the register of voters, and have further resolved to apply to other corporations and municipal bodies, asking their co-operation in the matter.

From a return prepared, and recently issued, by a Committee of the Corporation, it appears that the total number of names on the register (less 6752 liverymen, who are entitled to a parliamentary vote only), is 25,502. The number of voters not directly paying rates is 20,200; being 79·21 per cent. The lists of electors, however, contain duplicate registration; but without considerable labour it is impossible to say to what extent. The true percentage of voters not paying rates is, therefore, greater even than 79·21 per cent. The following are the particulars of limited companies, societies, &c., who have no votes, and their approximate rateable value:—

	Number.	Approximate Rateable Value.
Limited companies, societies, &c., not paying rates direct	5737	.. £2,828,035
Limited companies, societies, &c., paying rates direct	1434	
Public undertakings (gas, water, electricity, &c.) and railway companies, including railway stations	22	.. 406,349
Government property	—	.. 88,087
Property of livery companies on which they pay rates	—	.. 95,618
Total		£3,428,089

The rateable value of the City, including the Temples, on April 6, 1906, was £5,360,197; and the above approximate rateable value of £3,428,089, in respect of limited companies, &c., is 63·95 per cent. of the total. The total rate in the pound for 1906 averaged 6s. 9½d.; and the amount raised in cash for that year was, therefore, about £1,820,234. Of this, 63·95 per cent., equal to £1,164,122, was paid by limited companies, societies, &c., who were not represented on the register. Commenting on these facts, Mr. G. C. James, the Assessment and Rates Clerk for the City, points out that the proportion of rates paid by voters on the register is a little over one-third. Even the remaining 36·05 per cent. of the rates collected, equal to £656,112, is not fully represented on the register by persons who actually pay the rates.

Sales of Stock and Shares.—Mr. J. T. Moore recently sold 261 ordinary £10 shares (7 per cent.) in the Annfield Plain and District Gas Company at par. Last Thursday, Mr. George Nichols, of Messrs. Nichols and Co., sold 300 £10 preference shares (6 per cent.) in the Portishead Gas Company, Limited, in lots of £100 and £50 each. The former fetched £109 to £111, and the latter £55 and £56 each.

Ex-Gas Manager's Strange Death.—The remarkable death which occurred at Alton, Hants, on Sunday, the 15th inst., of Mr. Frederick Barnley, formerly the Manager of the Alton Gas-Works, gave rise to a Coroner's inquest last Tuesday. It appeared that, acting upon instructions, a superintendent of police went to the deceased's laundry with a search warrant on the 14th inst. to ascertain particulars with respect to an allegation of robbing the Gas Company; and the deceased admitted that he had being using two meters. The officer took one away, and the same evening he served a summons upon the deceased, charging him with the robbery. On being called to breakfast at nine o'clock next morning, his wife found him in an unconscious condition; and he expired shortly after being seen by a medical man. The autopsy was to the effect that death had resulted from fatty degeneration of the heart, probably accelerated by worry. The verdict returned was to this effect.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Scottish Junior Gas Association—Western District—were on a visit this afternoon to the works of the Stirling Gaslight Company. Though it was a Junior gathering, there were one or two present who renewed their acquaintance with the works after a lapse of three months—having been present on Sept. 17, when the new plant the Juniors came to see was inaugurated. The Juniors were much more critical in their examination than were the Seniors; but the plant, in the matter of construction, bears a close scrutiny, and in the matter of working we had the assurance, from the Chairman of the Company and others, that it is giving the utmost satisfaction.

In the Corporation of Glasgow there is a division of opinion over the question of extending the city by means of the annexation of outlying areas, as to the merits of which nothing need be said here. Last summer, it will be remembered, an attempt was made, before Parliament, to secure to the Corporation the right to supply water in the Busby district. This was an annexation movement; the feeling underlying it being that if they could obtain the right to supply water, the promotion of full annexation would be greatly helped. The Corporation were not successful upon that task; and it would now seem, from part of the proceedings at the meeting of the Town Council on Thursday, as if the gas supply were being dragged into the region of disputation. Bailie Montgomery, the new Convener of the Gas Committee, moved the adoption of the minutes of the Committee, in which it was proposed that the Corporation should proceed with the extension of the gas-mains to Giffnock; that, as the Busby Gas Company were at present supplying gas in Giffnock, the Corporation be asked to express to the Company their desire to purchase, if the latter were willing to sell at a fair valuation, their mains and pipes laid in that district; and that, in the event of the Company agreeing to consider the proposal, it be remitted to a Committee to meet the Company and to report. It may be mentioned here that the Corporation of Glasgow possess statutory powers to supply gas in the Giffnock district, and that therefore, in so far as the Busby Company serve the district, they are in the position of squatters; and it is observable that the proposal is not to take over the undertaking of the Company, but only to purchase their mains and pipes. This is, on the face of it, not a very fair proposal on the part of a powerful Corporation to a small undertaking, the annual output of which is only 9 million cubic feet. But that is only a detail. The offer of gas at 2s. 1d., as compared with 4s. 7d., per 1000 cubic feet, charged by the Busby Company, is a powerful reason why the residents in the district should fall in with the proposal of the Gas Committee; and if the matter were arranged as proposed, the annexationists would be greatly strengthened in their position, because they could then plead that the inhabitants, benefiting by the cheaper gas supply of Glasgow, ought to bear their share of the burdens of the citizens generally. Bailie Montgomery supported the proposal in the minutes. Bailie Guest moved that the minute be remitted to the Committee for further consideration. He did not think, as a member of the Gas Committee, that sufficient information had been received on the subject. Moreover, by acting on the recommendation of the Committee, they would be taking away one of the strongest arguments in favour of annexation. Mr. Macmillan moved that the recommendation of the Committee be that the extension of the gas-mains to Giffnock be proceeded with; and that the portions relating to the Busby Gas Company be deleted. Mr. W. F. Anderson wanted the borders of Glasgow to be extended, and the people in that area to get all the privileges of the city, if they were prepared to share in their responsibilities. But it would be a stupid thing if they took the small insignificant area of the Busby Gas Company, and tied themselves up to do certain things, while they had at Thornliebank a larger Gas Company, with whom they were making no arrangement. Mr. Willock said that in going to Giffnock they were extending their works legitimately, and exercising the powers created by Act of Parliament. It was no argument to say that because they made the extension to Giffnock they should also go to Thornliebank. If Thornliebank made application, it would be for the Gas Committee to consider it. He thought that the subject of annexation should be kept out of the case, and that the matter was purely a commercial one. Bailie Montgomery accepted the amendment—and it was adopted by 42 votes to 11—for a recommittal of the subject. So the people of Giffnock are to have Glasgow gas brought to their doors, without more ado, and the Busby Gas Company are to be ruthlessly ousted.

The account of the proceedings at Cowdenbeath last Tuesday, given in another column, at first sight appears to be on the ample side, when the size of the undertaking there is taken into account. But Cowdenbeath deserves more than a customary notice, because of the great rapidity with which it is developing—both as regards the town itself and the gas undertaking. Had it not been for the foresight of a few gentlemen, chiefly from Edinburgh, the probability is that long ere now there would have been no gas supplied in Cowdenbeath. The Company who began the concern did not conduct it in such a way as to secure or retain business. They could not make coal gas popular; so they took to supplying oil gas, but were unfortunate in this line also. Finally, having bungled both coal and oil gas supply, they began to employ acetylene. The community had been apathetic under the coal and oil gas *régimes;* but acetylene, as supplied, was more than they could bear, and the business of the Company had all but left them when a band of men with up-to-date notions took over what remained. They have managed affairs with so much common sense and intelligence that a huge success has resulted; and there is no saying to what height the Company's business may yet rise.

The Fraserburgh Town Council met specially on Thursday to resume consideration of a resolution proposed on the 25th of April last, to the effect that the Burghs Gas Supply (Scotland) Act, 1876, be adopted. Provost Finlayson said he was certainly not going to move the adoption of the resolution. As they all knew, a Special Committee was appointed for the purpose of gathering all information to enable them to decide whether it would be advisable to purchase the existing gas-works or to

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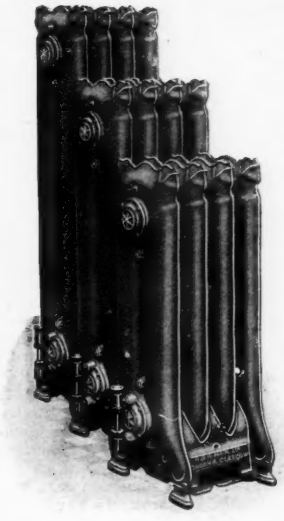

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introduce electric lighting for the town. Unfortunately, on account of the enforced absence of the Convener of the Committee, no meeting of that body had been held. They were met there that day in the curious position that they had no expert information before them whatever. He was therefore not prepared to support confirmation of the resolution. Another item they must take into account was that since they first began to consider the question of municipalizing the gas supply the cost of money had become very much dearer. They had also to consider the other and more pressing schemes in view. Mr. Edward Gordon, the Convener of the Special Committee, said that his absence from the town did not necessarily prevent the Committee from meeting. No expert advice was needed till they came to closer quarters with the Gas Company. He understood the meeting that day would be merely a formal affair. If they adopted the resolution, it did not mean that they were to purchase the gas-works right away. The ratepayers would have to be consulted first. The Fraserburgh Gas Company was formed sixty years ago by a few public-spirited individuals, not for the purpose of making money, but to supply the town with gas light. No shareholder was allowed to hold more than 100 shares. There were 2000 shares issued of 16s. each paid up. The dividends gradually increased, until, about ten years ago, they amounted to 12 per cent. The Company were now paying what was practically equal to a 50 per cent. dividend. They had a monopoly. If the present dividends did not suit them, they had only to put on another 1d. or 2d. per 1000 cubic feet. One previous attempt had been made by the Town Council to purchase the gas-works. That was in 1888, when, he believed, they could have been acquired for £6000. The cry had been raised that as they had so many big schemes on hand, the question of acquiring the gas-works could afford to stand over. But if they entered into possession of these works, they took over a paying concern. Nothing would be added to the rates, and in five or six years' time the town would benefit greatly. Provost Finlayson said that Mr. Gordon had made a very temperate statement; but they had no data to go upon, and in the interests of the ratepayers they were bound to get some expert advice as to the cost. If they could convince him that gas was the cheapest and best thing for the ratepayers, then he would favour the proposal. Electricity was making rapid strides, and in a few years time the Council might want to adopt it as the mode of lighting the town. Bailie Robb said that at one time the whole works could have been bought for £8000; and the price might soon rise to £16,000 or more. He suggested that a meeting of the Special Committee should yet be held, and the Council meeting adjourned. Mr. Edward Gordon moved that the meeting be adjourned to the first Monday in March. This was agreed to unanimously. A new Special Committee was then appointed, with Mr. Gordon as Convener, to carry out the former remit—that all information be got to enable the Council to decide whether it would be advisable to purchase the gas-works or introduce electric light.

To-morrow, I think, is recognized as the shortest day, and the lengthening days we shall soon be conscious of will bring relief to gas managers who are in straits to keep up the supply. In no place, probably, will the relief be more welcome than in Dunfermline, where, at the present moment, there is great difficulty in meeting the demand for gas. At the Town Council meeting last week, Mr. Hoey suggested that Bailie Stewart, the Convener of the Gas Committee, should make a statement to assure the community that they would get gas. Complaints about the quality of the gas had come from all round. Bailie Stewart said that very unfortunate circumstances had arisen, for which they took full responsibility, and which he need not explain there. The promises which had been given were sometimes not fulfilled; and on the previous Friday there was a want of pressure. Since then, however, there had been no lack of it.

The water supply of Kelso is a subject which has given no little trouble to the Town Council, and, so far as appearances go, is likely to do so still. This week, at a meeting of the Council, it was reported, on behalf of the Water Committee, that the boring operations for water at Wooden Anna had so far resulted in failure; a depth of over 105 feet having been reached without water being obtained. Provost Crichton Smith proposed that it be remitted to the Water Committee to further consult Dr. Thresh; and the motion was carried.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 21.

Sulphate of Ammonia.

In the early part of the week the market was very quiet; but better demand developed later, and a fair amount of business has been done. Probably the necessity for providing for the month's contracts before the holidays stimulated the activities of buyers, and occasioned the larger amount of buying—transit by rail to shipping ports being too unreliable during Christmas week. The closing quotations are £11 13s. 9d. to £11 15s. per ton f.o.b. Hull, £11 16s. 3d. to £11 17s. 6d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. In the forward position, too, there has been considerable inquiry, but buyers are still endeavouring to get in at prices which makers are not disposed to entertain.

Nitrate of Soda.

This article is dearer, spot prices being advanced to 11s. 4½d. per cwt. for 95 per cent. and 11s. 7½d. for refined quality.

LONDON, *Dec.* 23.

Tar Products.

There is little alteration in the market for tar products, and matters will doubtless now remain in abeyance until the New Year. Pitch keeps in about the same position. Makers are anxious to sell for near delivery; but the demand from the Continent is very small. Creosote is still in about the same position. In London, 2⅝d. would be accepted for prompt delivery; but for forward, manufacturers ask 2¾d. to 2⅞d. In the Midlands, makers are well sold, and ask 2⅝d. to 3d. In the Lancashire district, 2½d. to 2⅝d. is asked *ex* makers' works, and in Yorkshire about 2⅝d. Although not very much business is doing, 90 per cent. benzol is steady. Some quantity has been sold in the North at

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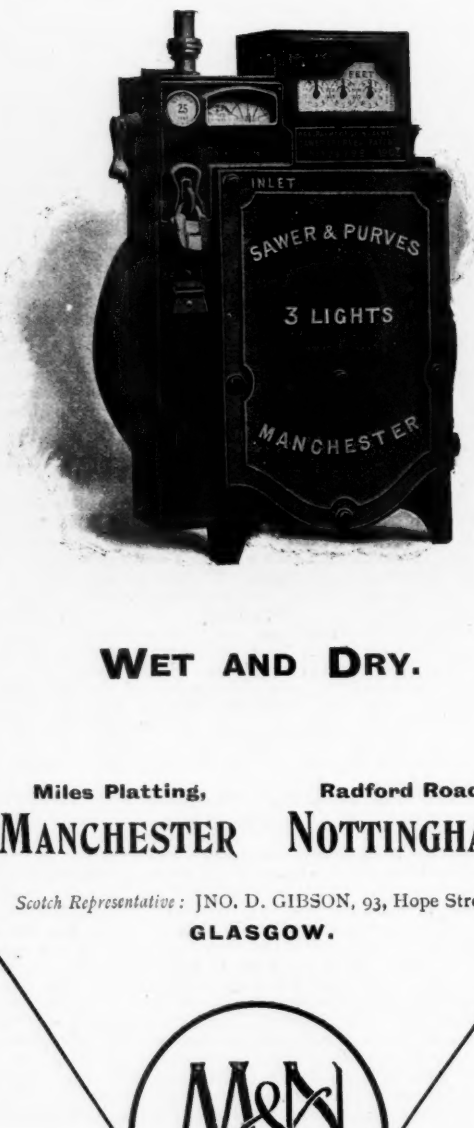

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8¼d. per gallon to the end of June. In London, 8¼d. was taken for prompt delivery; and a further parcel which was offered at the same figure was declined. There is little demand for either 50-90 per cent. benzol or toluol. Solvent naphtha is quiet; and very reasonable figures are said to have been accepted for delivery to the end of June next. Crude carbolic remains in about the same position. Business is reported to have been done on the east coast at 1s. 7d. for delivery to the end of June; and Continental consumers now refuse to offer more than 1s. 6¾d. Creosote salts continue in good demand.

The average values during the week were: Tar, 13s. 6d. to 17s. 6d., *ex* works. Pitch, London, 23s. to 23s. 6d., f.o.b.; east coast, 21s. to 21s. 6d., f.o.b.; west coast, 20s. to 21s., f.a.s. Benzol, 90 per cent., casks included, 8¼d. to 8¾d.; North, casks included, 8d. to 8½d.; 50-90 per cent., casks included, 8d. to 8¼d. Toluol, casks included, 10d.; North, 9¼d. to 9¾d. Crude naphtha, in bulk, 3¾d. to 4d.; North, 3½d. to 3¾d.; solvent naphtha, casks included, 11d. to 1s.; North, casks included, 9¼d. to 10½d.; heavy naphtha, casks included, 11d. to 1s.; North, casks included, 10½d. to 11d. Creosote, London, in bulk, 2⅛d. to 2⅜d.; North, 2¼d. to 2⅜d. Heavy oils, in bulk, 3½d. Carbolic acid, 60 per cent., 1s. 7d. to 1s. 7½d. casks included. Naphthalene, £6 10s. to £12 10s.; salts, 42s. 6d. to 45s., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1¾d., packages included and delivered; "B" quality, unsaleable.

Sulphate of Ammonia.

This article is unaltered. There is little demand at present for prompt delivery; while for forward, the figures put forward by dealers do not interest makers at present, who are believed to be fairly well sold. The principal London Companies offer £12 2s. 6d.; but outside makes can be secured upon Beckton terms at £11 13s. 9d. to £11 15s. In Hull, business is reported to have been done at £11 15s.; and in Liverpool at £11 16s. 3d. to £11 17s. 6d. In Leith, the market is nominally £12 2s. 6d., but practically no business has been done.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Expectancy is general that the price of steam coal will be raised at the beginning of the New Year. Last week there was a rise of 6d. per ton for the same class of coal in the Wigan districts; but it was not general. For Manchester new contracts are not concluded under an advance, compared with 1907 prices, of from 3s. to 3s. 6d. per ton. The trade in house fuel is increasing. Gas coal and cannel are being required at the various gas-works. Just now the maximum deliveries are being supplied. Spot lots for gas companies are being sold at 1s. per ton above the last contract prices, which works out at an advance of 3s. 6d. per ton on last year's contracts. Coal for shipping continues in fairly strong demand. Quotations at the Manchester district pits are as folllows: Best house coal 15s. to 16s. 6d. per ton, secondary 14s. to 15s., common 12s. to 13s. 6d., burgy 10s. 6d. to 11s. 4d., best slack 9s. 6d. to 10s. 4d., medium 8s. 6d. to 9s., and lower qualities 7s. 9d. to 8s. 4d. Coal for shipping is 13s. to 14s. 6d. f.o.t at the tips. Furnace coke is 19s. to 25s.

Northern Coal Trade.

The demand for coal is full, though there is not much pressure—the milder weather having an influence; while the output is also very full at present. There is a good inquiry for steam coals for this year; but for next year prices are lower, owing to the fact that there is less contracted for ahead than was the case twelve months ago. Best Northumbrian steam coals are from 13s. to 14s. per ton f.o.b. for early delivery. For second-class steams 12s. 6d. to 13s. is quoted, and steam smalls from 6s. 10d. to 7s. 3d. In the gas coal trade, there is now the period of the heaviest demand; and the shipments have been full, especially with the best collieries. Prices of Durham gas coals vary from about 12s. 3d. to 14s. 6d. per ton f.o.b., according to quality; but where long forward delivery is arranged for, some concession in price is asked. Sales are being attempted for export for next year; but the difficulty just named as to varying views regarding the prices that will rule makes sales only slow. Second-class gas coals seem to be plentiful, even at this season. The coke trade is rather more active; the needs of the ironmasters being always fuller before the holidays. With ample supplies, however, all classes of coke are easier. Gas coke is now about 19s. per ton f.o.b. for export; while full supplies are influencing the local house consumption of gas coke.

Scotch Coal Trade.

Trade is quiet. Large coal is well taken up till the end of the year; but small sorts are continuing to meet with a lessened demand, with the result that these classes are threatening to accumulate at the collieries. The prices quoted are: Ell 13s. 6d. to 15s. per ton f.o.b. Glasgow, splint 15s. to 15s. 3d., and steam 13s. to 13s. 3d. The shipments for the week amounted to 268,561 tons—a decrease of 13,577 tons upon the previous week, but an increase of 28,340 tons upon the corresponding week of last year. For the year to date, the total shipments have been 14,189,772 tons—an increase of 895,694 tons upon the corresponding period of 1906.

Public Lighting on Moonlight Nights.—The St. Ives, Cornwall, Town Council had under consideration last week the old question of how far the moon can be relied upon to do duty as a public illuminant in a town which wishes to be regarded as up-to-date. In view of the inconvenience experienced on several recent occasions when the moon has been obscured by clouds, the Lighting Committee put forward a modest proposal for amending the system of lighting. It was suggested that 21 lamps in the town should be kept alight all night, discretion being given to the inspector as to the hours of lighting on moonlight nights. It was also proposed that he should take instructions from the Chairman of the Committee about the hours of lighting on moonlight nights when the moon was likely to be obscured. An amendment was, however, moved to the effect that the lamps should not be lit on bright moonlight nights, and that the lighting of them or otherwise on doubtful nights be left to the Chairman. This amendment was carried.

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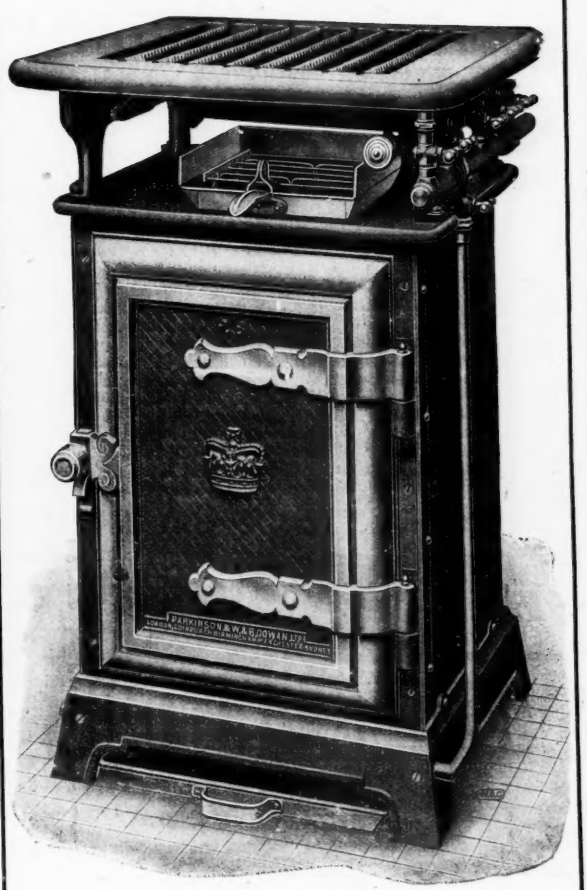

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BIRMINGHAM.

Acetylene Explosion at Angmering.—A porter in the employ of an Angmering grocer has been terribly injured by an acetylene explosion, which occurred when he was in the generating shed. It is said that the whole village was startled by the report; and that "the man's cap, together with nuts, screws, parts of the generator, and other articles, were found in the garden adjoining the yard, while half the roof of the shed was blown off by the explosion. The cause of the occurrence is not explained.

Accident at the Stockport Gas-Works.—An inquest was held at Stockport last Saturday week regarding the death of a man named John Carney, who was employed in the purifier-house at the gas-works. Deceased was found on the floor behind the door of the engine-room "gassed;" and artificial respiration, and the use of the cylinder of oxygen, which is kept in readiness for such cases, were unavailing. The doctor on arrival found that the man had been dead some time; and a post-mortem examination showed that death had been caused by asphyxia, due to carbon monoxide poisoning. There was no evidence to indicate how the fumes had been inhaled. The Town Clerk expressed, on behalf of the Corporation, the deepest sympathy with the widow and family of the deceased; and the Jury returned a verdict in accordance with the medical evidence.

Eliza Wobley, a widow, of Wolverhampton, was last week found dead in bed; and in her mouth was a rubber tube the other end of which was attached to a fully turned on gas-burner.

In the Chancery Division of the High Court of Justice on the 13th inst., Mr. Justice Parker made an order for the appointment of a Receiver and Manager of the business of Messrs. Wright and Butler, Limited, of Birmingham.

We have received from the Hopkinson Gas Plant Company, of Huddersfield, their list No. 150 of suction, suction pressure, and pressure gas plants, for coke, anthracite, charcoal, &c. It is an illustrated quarto pamphlet of 24 pages, and furnishes full information in regard to the plant shown.

It has become necessary at Cuckfield to lower the wells which furnish the public water supply; and in reporting the commencement of operations the Manager of the water-works has informed the Parish Council that by a test made between midnight and 4 a.m. the loss from the mains and services was at the rate of 67,000 gallons per day. When similar tests were made in January last, the daily loss was estimated at 90,000 gallons.

A Local Government Board inquiry was held last Thursday at Croston into an application by the Urban District Council for sanction to borrow £1750 for water supply purposes. The Clerk (Mr. J. Forshaw) said an arrangement had been made with the Manchester Corporation for the supply of water to the village. Croston would pay £120 a year for thirty years to the Chorley Rural District Council for the privilege of having the water supplied through their mains; and at the end of that period, Croston would be entitled to a continuance of the supply.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

SECRETARY AND GENERAL MANAGER (WATER). No. 4882.
SUPERINTENDENT OF DISTRIBUTION. Nottingham Gas Department. Applications by Jan. 11.
GAS MANAGER. Jedburgh Gas-Works. Applications by Dec. 31.
MANAGER (WASHERY COKE OVEN WORKS). Powell Duffryn Steam Coal Company.
DESIGNER OF JIGS, &c., FOR PREPAYMENT ATTACHMENTS. No. 434, c/o Robertson and Scott, Edinburgh.
CLERK (JUNIOR). Stretford Gas-Works.

Situations Wanted.

GENERAL FOREMAN. No. 4886.

Pupil Required. No. 4887.

Plans, Drawings, &c., Prepared. No. 4883.

Plant (Second-Hand), &c., for Sale.

BOILER. Redditch Gas-Works.
STREET LANTERNS. Electricity Works, Fulham.

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PIPE SCREWING MACHINE. Burwash Gas-Works.
STATION METER. No. 4885.

TENDERS FOR

Coal.

COPENHAGEN LIGHTING DEPARTMENT. Tenders by Jan. 4.

Fire Clay Goods.

ROCHDALE GAS DEPARTMENT. Tenders by Jan. 8.

Iron and Steel Work, &c.

SHEFFIELD GAS COMPANY. Tenders by Jan. 7.

Retort-Bench Fittings, Mouthpieces, Hydraulic Mains, &c.

SHEFFIELD GAS COMPANY. Tenders by Jan. 7.

Tar and Liquor.

GAINSBOROUGH GAS DEPARTMENT. Tenders by Jan. 1.
HARWICH GAS AND COKE COMPANY. Tenders by Jan 6.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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